FIRE LIFE SAFETY REPORT

Taylor Place
120 E. Taylor Street, Phoenix, Arizona

Prepared by:
Christopher Thomas
Cal Poly – San Luis Obispo
FPE 596 – Culminating Project

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Keywords: High Rise, Residential, Dormitory, Life Safety Code, RSET, ASET, Performance Based Design, Fire Dynamics Simulator (FDS)

EXECUTIVE SUMMARY

This document is a Fire and Life Safety Report on the Taylor Place Dormitory located in Phoenix, Arizona as part of the Arizona State University (ASU) downtown campus. The building was evaluated on a prescriptive basis based on the current City of Phoenix building codes and further evaluated on using performance based methods from the Society of Fire Protection Engineers (SFPE) Handbook and National Fire Protection Association (NFPA) 101 Life Safety Code®.

These building features and systems were evaluated using prescriptive methods:

- General construction, fire resistive construction and fire resistive separations
- Occupancy, Life safety features and building egress
- Smoke management systems and features
- Fire protection systems, fire sprinkler, suppression systems, fire alarm
- Emergency and standby power, elevators, communication systems, and lighting

A performance-based analysis of the South Tower and Ground Floor Cafeteria and Assembly space using NFPA 101 Life Safety Code® Chapter 5 as a guide. The analysis of the South Tower was based on NFPA 5.5.3.1 and a typical fire for the occupancy accounting for occupants, number and location, room sizes, contents, fuel properties, ventilations, and identifying the location of the item ignited. The analysis of the Ground Floor Cafeteria and Assembly Area was based on NFPA 5.5.3.2 and an ultra-fast fire in the primary means of egress reducing the overall means of egress by two double door exits. These scenarios are analyzed using tenability criteria to determine if with the given the design fire, all occupants can exit safely.

Taylor Place generally meets or exceeds the prescriptive requirements for the system described above provided in the building code. Two specific areas were identified requiring further analysis: the corridor and two-story vertical opening separation is not provided in the South Tower per PBC Section 712, and the reduction in the door size of the south egress corridor on the ground floor. Both of these issues were addressed in conjunction with the performance based analysis and found to be acceptable with the current set of performance based recommendations.

The performance-based analysis was largely successful. The analysis of the ground floor egress given an ultrafast fire located near the southwest corner of the assembly space found occupants Required Safe Egress Time (RSET) was greater than the Available Safe Egress Time (ASET) meaning all occupants egressed safely. The visibility was lost in the cafeteria which caused the failure of the tenability criteria and the determination of the ASET. The second analysis of the two-story vertical common area in the south tower failed the tenability criteria for visibility during the first two evaluations. It was determined that the two furniture

standards as part of the ASU design guidelines varied greatly in fire behavior and smoke production. As a result, the furniture in the common areas meet the recommended requirements, the corridors will not require separation from the common area.

As part of the evaluation process, there are additional recommendations in the report including the addition low level egress signage in the corridors to aid egress, a smoke barrier in the entrance lobby, and the reasons are discussed in more detail in the report. Comments and recommendations can be found at the end of each section providing additional detail in specific areas.

The end of the report focuses on Commissioning of fire protection and building systems. A team is needed to effectively test all of the fire protection systems in accordance with their performance requirements. Functional tests performed on each system to ensure each systems were installed correctly. For example, stair pressurization systems can rely on several fans to pressurize each stairwell. A functional test will typically quickly reveal problem areas and you may even find a motor running backwards. Valuable information is provided from this stage in the project to identify maintenance requirements and finalize documentation. Fire fighter operation overviews need to be assembled, operation and maintenance manuals need to be created for building staff, and fire safety plans need to be implemented. It is very much a documentation and punch list phase of the project.

I hope you enjoy your new building.

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1. INTRODUCTION AND ORGANIZATION

This Fire Life Safety Report is a prescriptive and performance based design document. It has been developed to describe a coordinated/consolidated systems approach to all active and passive fire protection and life safety features of the dormitory.

All applicable fire protection aspects required by Code, as well as any additional fire protection aspects required by Code and City Amendments, as well as any additional fire protection features incorporated into the entire facility are described herein using a general format. How these fire protection features function independently and interact is described.

The report is written in a general format according to samples provided of an older City of Phoenix (COP) for Fire Life Safety Reports (FLSRs) template. The source material for the report is several visits to the publicly accessible areas of Taylor Place, and a partial set of design drawings in pdf format.

It is loosely based the current COP FLSR template and grouped as follows

- Building Construction
- Fire/Smoke Resistant assemblies
- Fire Protection, Fire Alarm, and Life Safety
- Means of Egress Systems and Components
- Performance-Based Analysis
- Commissioning

The current City of Phoenix for Fire Life Safety Reports (FLSRs) template is based on NFPA 3 *Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems (2012)*. The City of Phoenix checklist for the report is provided in the Appendix A, if the reader is curious. This template is difficult to follow and not written in a narrative style, so a general format was used.

This document is to be used as a basis for design and drawing preparation. Plans detail the specifics of how the facility complies with this document and the applicable Codes.

The primary focus of this report is the South tower and ground floor assembly because of occupant loads, configuration, and performance based analysis. Although the ground floor resident assistants and offices are important, they are largely segregated. The North Tower is primarily residential dormitory rooms that resemble a hotel and the comments provided for the South tower typically apply to the north tower.

2. APPLICABLE CODES

The Building Code in the City of Phoenix follows the 2012 International Building Code with City of Phoenix Amendments which is then referred to as the Phoenix Building Code (PBC). The Taylor Place dormitory is a privately owned building located in the Arizona State University (ASU) downtown campus in the City of Phoenix. Since the property privately owned, City of Phoenix Codes apply as opposed to the Board of Regents. In the event of a conflict, the local code prevails unless the Life Safety Code is more restrictive.

City of Phoenix has adopted the following codes which are applicable to this project:

2012 Phoenix Building Code (PBC)
2012 Phoenix Fire Code (PFC)
2012 International Mechanical Code (IMC)
2012 International Fuel Gas Code
2012 International Code Council Performance Code
2011 National Electrical Code / NFPA-70

2010 ASME A17.1 Safety Standard for Elevators and Escalators
2002 ASME A17.3 Safety Standard for Existing Elevators and Escalators
2011 ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts

2012 NFPA 101, Life Safety Code
2011 NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
2010 NFPA 13, Standard for the Installation of Sprinkler Systems
2013 NFPA 72 National Fire Alarm and Signaling Code
2012 NFPA 3, Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems

Despite being built in 2009, the current 2012 International Code Council codes were utilized to gain familiarity with the standard of practice.

3. DESIGN RESPONSIBILITY

Project design professionals in responsible charge for this project are:
ARCHITECT
MECHANICAL/PLUMBING ENGINEER
ELECTRICAL ENGINEER
STRUCTURAL ENGINEER
FIRE PROTECTION ENGINEER

INTERIOR DESIGNER

4. BUILDING CONSTRUCTION

INTRODUCTION

In the following section of the report provides an Overview of the occupancy and construction requirements. The occupancy type drives the construction methods to provide minimum levels of safety for the occupants of the building. This is reflected in the allowable area of each floor, and height of the building as well as the type of construction: combustible, or non-combustible.

OVERVIEW

The Arizona State University (ASU) dormitory is a thirteen story high-rise with a North and South residential towers, assembly, and resident services on the ground level. It was completed in 2009 for $116,624,000. This is part of the modern ASU campus in the City of Phoenix in the state of Arizona. Open air pedestrian bridges at each residential floor provide cross communication of residents and access to the elevators. The building is provided with an automatic fire sprinkler system, fire alarm, fire emergency/alarm communications systems, 24-hour security guard, and resident assistant on staff.

The site is bounded by E. Fillmore Street, N. 2nd Street, E. Taylor Street, and N. 1st Street. The building is 13 stories, approximately 126 feet high to the roof slab with 720 dorm rooms and 1250 beds. Service access is on the east side of the building and an open plaza is on the west side of the building.

Representative drawings are included in the Appendix F showing a general layout of the building. They show the floor plan views, stairway detail, and exterior elevations. This is a limited set of the available drawings due to file size limitations. Additional drawings and detail are available upon request. Throughout the report, the dormitory towers are referred to by their cardinal position as north and south as well as other features. Compass points are added to improve orientation.

Fire Department connections are located on the north and south side of the building with accessible Knox boxes. The fire department command center is located next to the security desk just inside the south entrance.

GENERAL USE AND OCCUPANCY

The basement level is a service level with mechanical equipment including pumps, generators, hot water heaters, and electrical equipment. Storage of flammable and combustible liquids are not permitted in the basement. Parts and supplies for mechanical and electrical repairs and building maintenance are stored on this level. The basement is considered a Storage (S-1) occupancy in accordance with PBC Section 311.1.

The ground floor contains a large assembly area, cafeteria and dining Tables, a café, administrative offices, and Resident Assistant (RA) suites as shown in Figure 1. The South Tower at ground level consists of a coffee shop, and business or mercantile spaces that can be subdivided into 6 individual suites. Non-public areas on the ground floor include a loading dock, storage, offices, and access to the basement. This ground level is mixed use with several different occupancies. There are residential (R-2) areas for the resident assistant suites, assembly areas (A-2/A-3) for community areas, cafeteria, and restaurants, business areas (B) for building management and student services, and mercantile (M) shops. Storage (S-2) areas are located on the ground floor for storage, fire command, and fire equipment.

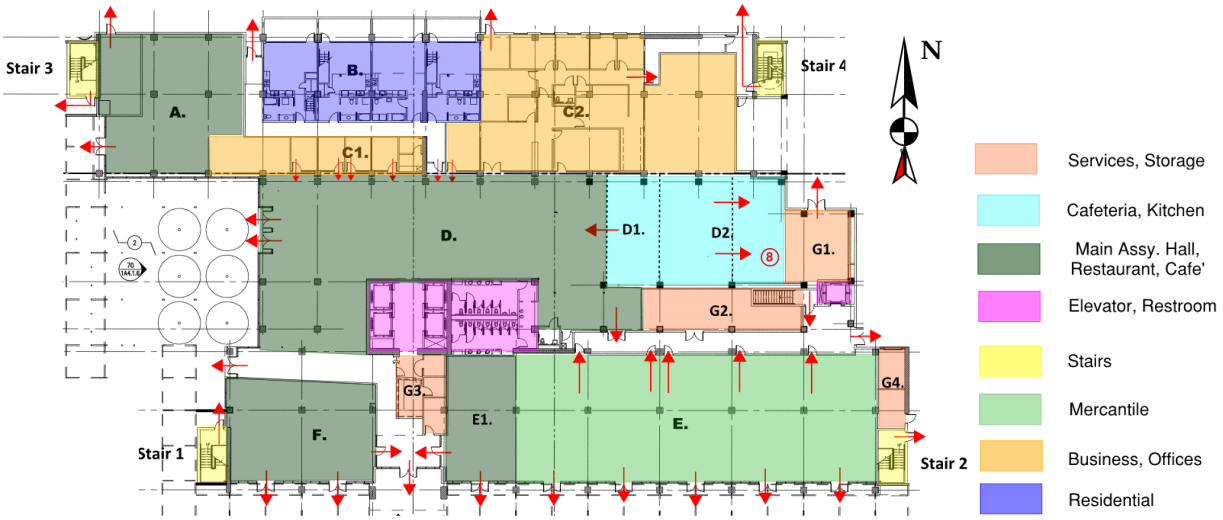

FIGURE 1. GROUND FLOOR OCCUPANCY TYPES AND EXITS

The second floor thru the thirteenth floor of North and South Tower consist of student dormitories shown in Figure 2. Each floor has living space with laundry facilities, elevator access, and an open air bridge connecting the North and South towers. A small common area (A-3) in the South tower connects the 2nd and 3rd floors by a convenience stair which is not part of the egress path. This configuration is repeated on all the floors above. The dormitory levels are residential (R-2). There are additional Utility (S-2) areas for shared laundry and kitchen areas.

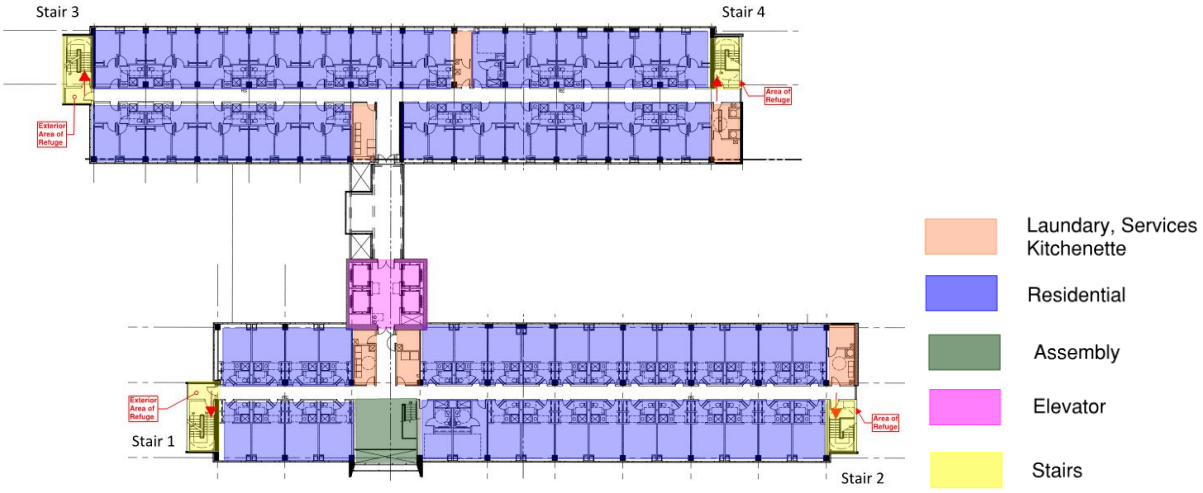

FIGURE 2. TYPICAL DORMITORY FLOOR OCCUPANCY TYPES AND LEGEND

This information is summarized in Table 1 which lists the floor with the occupancy classifications, area, and descriptions of the occupancy.

TABLE 1. OCCUPANCY CLASSIFICATIONS AND AREAS

FLOOR	GROUP	AREA (SF)	OCCUPANCY DESCRIPTIONS
BASEMENT	S-2	6,700	Mechanical and electrical equipment, maintenance supplies, maintenance shop
GROUND	A-2	2200	Restaurants on perimeter
	A-2	510	Cafeteria area (standing room)
	A-2	5,369	Open seating and community space on the ground floor is provided with dining Tables which could be relocated to use the space for various functions.
	B	6,100	Staff, resident assistants, administrative, and building security areas.
	M	5,610	Areas can be used for restaurants, businesses, or mercantile.
	R-2	2,150	The dormitories provide sleeping and habitation for students.
	S-2	2,110	Storage, Fire Command, Electrical, Loading Dock
TWO TO THIRTEEN	R-2	South Tower - 9,250 North Tower - 9,720	The dormitories provide sleeping and habitation for students.
	S-2	South Tower - 580 North Tower – 630	Several areas have been designated for storage of supplies, janitorial equipment, and mechanical equipment.
	A-3	South Tower - 330 upper 430 lower	Located on each floor 2-13 are small common areas linking two floors. These areas where students will gather and will not have fixed seating.

CONSTRUCTION TYPE

At 126 feet above grade, Taylor Place meets the requirements of a high-rise given in PBC section 202 and has special detailed requirements in Phoenix Building Code (PBC) section 403 High-Rise Building. Buildings over 75 feet above the lowest level of fire department access present special challenges to fire protection and egress that require additional features to ensure occupants are well protected.

FIGURE 3. TAYLOR PLACE UNDER CONSTRUCTION - NORTH TOWER AND ELEVATOR SHAFT

ALLOWABLE AREA

The construction type for the building is Type IB non-combustible (Figure 3) protected which allows for unlimited floor area construction and up to 11 stories in accordance with PBC Table 503 for prescribed building heights and allowable floor area shown in Table 2. Providing an automatic sprinkler system with supervised initiating devices and water-flow initiating devices allows for a reduction in construction type per PBC 403.2.1 to Type IIA for the residential floors two through thirteen. However, for the purposes of this report the Type IB construction type is used. The residential levels are built on a podium and take advantage of the automatic sprinkler system increase in PBC section 504.2 increasing the allowable stories to 12 and the allowable building height to 180 feet. The PBC Type IIA construction type is similar to the NFPA construction classification Type II (111) providing non-combustible protected structural and roof construction elements.

Building height limitations are shown in feet above grade plane in Table 2. Story limitations shown as stories above grade plane. Building area limitations shown in square feet, as determined by the definition of "Area, building," per story

TABLE 2. EXCERPTS FROM PBC SECTION 503, GENERAL BUILDING HEIGHT AND AREA LIMITATIONS TABLE 503 ALLOWABLE BUILDING HEIGHTS AND AREAS

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	**B**	A	B	A	B	HT	A	B
	HEIGHT (feet)	UL	**160**	65	55	65	55	65	50	40
	STORIES(S) AREA (A)									
A-2	S	UL	**11**	3	2	3	2	3	2	1
	A	UL	**UL**	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-3	S	UL	**11**	3	2	3	2	3	2	1
	A	UL	**UL**	15,500	9,500	14,000	9,500	15,000	11,500	6,000
B	S	UL	**11**	5	3	5	3	5	3	2
	A	UL	**UL**	37,500	23,000	28,500	19,000	36,000	18,000	9,000
M	S	UL	**11**	4	2	4	2	4	3	1
	A	UL	**UL**	21,500	12,500	18,500	12,500	20,500	14,000	9,000
R-2	S	UL	**11**	4	4	4	4	4	3	2
	A	UL	**UL**	24,000	16,000	24,000	16,000	20,500	12,000	7,000
S-2	S	UL	**11**	5	3	4	3	5	4	2
	A	UL	**79,000**	39,000	26,000	39,000	26,000	38,500	21,000	13,500

CONCLUSION (BUILDING CONSTRUCTION)

Based on a prescriptive evaluation of the building it is in conformance with the 2012 International Building Code and NFPA 101 Life Safety Code®. The design is consistent with the requirements for allowable areas and building height.

5. DESIGN AND CONSTRUCTION METHODOLOGY

Demolition of existing site structures was completed prior to foundation work of the two towers. All underground utilities, pipes, and cabling were identified and relocated, capped, or disconnected as appropriate.

The two towers of Taylor Place are being constructed in two phases. The North Tower is to be constructed first, then the elevator bank, and the South Tower.

The building is to be occupied in stages initially occupying the ground floor mercantile and restaurant suites to provide services for the future tenants. This includes the completion of the cafeteria, resident assistant suites, and student services necessary to support the residential towers. Once the ground floor areas are complete the towers are occupied floor by floor as they are completed. A phased occupancy plan is to be provided to the Authority Having Jurisdiction (AHJ) meeting all requirements necessary for AHJ approval.

6. SPECIAL CONSIDERATIONS AND DESCRIPTION

This section is provided to highlight any special situations that would require a specific response to maintain a safe state. There are no special considerations for this building. It is a typical residential dormitory with resident services on the ground floor.

CRITICAL PROCESSES AND SYSTEMS

There are no energy management systems, or hazardous materials and processes requiring systems to maintain them in an operational state. The building mechanical systems are critical to the occupancy of the building. Although the residential floors are provided with operable windows, the building will be difficult to occupy on a hot summers day when the exterior temperature exceeds 110 degrees Fahrenheit.

HAZARDOUS MATERIALS/OPERATIONS

A hazardous materials inventory will be created to track any hazardous materials in the building. At this stage, there are no hazardous materials planned to be stored in the building.

EQUIPMENT AND SYSTEMS INSTALLED AS REQUIRE

Special inspection and observation certificates are required for mechanical and boiler systems. The manufacturer's installation instructions, maintenance procedures, and specifications are to be provided to verify proper installation.

7. FIRE RESISTANT AND SMOKE RESISTANT ASSEMBLIES

INTRODUCTION

This section describes applicable methods of fire resistive construction and property line mitigation which creates fire/smoke compartments throughout the facility.

Active fire protection systems have been coordinated to take into account the zones created by passive fire resistive construction. Detailed examples of fire resistive wall and assembly construction are located in Chapter 7 of the PBC. The building elements are described below, and summarized in Table 3.

TABLE 3. FIRE RESISTANT REQUIREMENTS FOR BUILDING ELEMENTS – PBC TABLE 601

BUILDING ELEMENT	TYPE I	
	A	B
Structural frame[a]	3[b]	2[b]
Bearing walls Exterior[g] Interior	 3 3[b]	 2 2[b]
Nonbearing walls and partitions Exterior		
Nonbearing walls and partitions Interior[f]	0	0
Floor construction Including supporting beams and joists	2	2
Roof construction Including supporting beams and joists	1½[c]	1[c, d]

GENERAL CONSTRUCTION CLASSIFICATION

The corresponding PBC construction is Type IB non-combustible protected which allows for unlimited floor area construction, 12 stories, and height of up to 180 feet above grade with the sprinkler protection per PFC 903.3.1.1 meeting the requirements of NFPA 13. This information is summarized and compared to the floor areas for each occupancy group in Table 4. This is appropriate for residential construction, educational, institutional, business, and assembly (>5 floors) and similar to NFPA Handbook, Type II (222) construction with structural elements made from non-combustible or limited combustible materials. With this type of construction there are no limits on the allowable area.

TABLE 4. ALLOWABLE BUILDING HEIGHTS AND AREA LIMITATIONS COMPARED TO BIULDING AREAS – PBC TABLE 603

FLOOR (SF)	OCC. GROUP	AREA (SF)	Type IB (160 height)
BASEMENT (6,700)	S-2	6,700	11 / 79,000
FIRST (35,500)	A-2	5,170	11 / UL
	A-2/A-3	8,320	11 / UL
	B	6,100	11 / UL
	M	5,610	11 / UL
	R-2	2,150	11 / UL
	S-2	2,110	11 / UL
TWO TO THIRTEEN (Tower 1-13,240) (Tower 2-12,600)	R-2	Tower 1 - 9,250 Tower 2 - 9,720	11 / UL
	S-2	Tower 1 - 580 Tower 2 – 630	11 / UL
	A-3	Tower 1 - 430	11 / UL

FIRE RESISTANT CONSTRUCTION

STRUCTURAL FRAME

The fire resistance rating of the structural frame of the building is steel reinforced concrete, non-combustible with a 2-hour construction per PBC Section 601. All bearing members which are essential to the stability of the building as a whole is 2-hour fire-rated construction unless they support more than one floor or the roof then they shall have 1-hour fire rated construction.

WALLS

All fire resistance ratings are prescribed by PBC section 601. All **interior** and **exterior bearing** walls are rated with 2-hour fire resistive construction. All **exterior non-bearing** walls of the towers, as well as the south, east, and west exterior walls of the first and second floors can be noncombustible construction since they are set back at least 40 feet from adjacent property lines or public ways. All **interior non-bearing** can be noncombustible construction. Resident laundries less than 100 square foot require 1-hour separation or sprinklers per NFPA 101 Table 28.3.2.2.2.

CORRIDORS

Corridors are rated as follows in Table 5 where required based on PBC Chapter 10.

TABLE 5. CORRIDOR FIRE RESISTANCE RATINGS FROM PBC TABLE 1017.1

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[c]
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S	Greater than 30	1	0
R	Greater than 10	Not Permitted	0.5
I-2[a], I-4	All	1	0
I-1, I-3	All	Not Permitted	1[b]

a. For requirements for occupancies in Group I-2, see Section 407.3.
b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Section 408.7.
c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.

i. BASEMENT

The main corridor thru the basement requires a fire resistance rating of 1 hour. There are no flammable or combustible liquids located in the basement, but there is mechanical equipment that may need to be accessed during an emergency.

ii. SHOPS AND ASSEMBLY

Between the Shops and Assembly area on the south side there is a corridor that provides egress from the assembly area and merchant shops. The egress corridor does not require a fire resistance rating because the building is protected with a sprinkler system.

iii. RESIDENT ASSISTANT SUITES AND OFFICES

The ground level resident associates suites require the corridor separating them from offices have a fire resistance rating of 1 hour.

iv. OFFICE SPACE

The ground level office area requires a fire resistance rating of 1 hour to protect the egress corridor to the north east stair.

v. SOUTH TOWER AND 2

The main corridor for floors 1 through 13 has a minimum ½ hour fire resistance rating and the doors have a 20-minute fire protection rating. The walls separating the common area from the residential suites is required to be 1 hour.

FLOORS

Floor separation is required to have a minimum 2-hour fire-resistive construction. The floor-ceiling separating the ground floor assembly area from the second floor R-2 occupancy is a minimum 1-hour fire-resistive construction.

VERTICAL SHAFTS

Floor and ceiling penetrations have the potential to spread a fire quickly through several floors. Openings in the shaft walls must be protected to prevent the spread of heat, smoke, and gases to other floors in the same building. PBC Section 712 and 713 prescribe the fire resistant requirements for the shaft walls and how these walls are constructed. In Taylor Place, these shaft are limited and penetrations are limited due to the compact air conditioning systems used in each dormitory room. This limits the size of ventilation units for corridor conditioning, and ductwork need to penetrate the vertical shafts.

Per PBC 713.4, openings between more than 4 stories are required to be enclosed in 2-hour rated shaft construction. All penetrations to be properly sealed. Openings between stories otherwise are enclosed in 1-hour rated shaft construction. The interconnection between the South Tower floor common areas in the dorm towers has have 1-hour fire resistant walls.

ROOF

The roof materials have not been determined at this time. The roof is designed to be non-combustible, membrane type roof covering with several inches of isocyanurate insulation. Typical Type IB construction roofs are 1-hour fire rated non-combustible construction.

STAIRWELLS

There are five stairwells in the building providing access and egress to all levels. The northwest, southwest, and south east stairs extend from the ground level to the top level. The north east stair starts in the basement and finishes at the top floor. A basement access stair is located near the basement elevator for egress and access to the basement. The enclosure is not rated.

The tower stairwell enclosures have a minimum fire resistance rating of 2-hours per PFC 1009.3.1.2 on the interior walls adjoining the building, and unrated exterior walls. The stairwells are designated north-west, north-east, south-west, south-east, and basement. The tower stairways are required to be smoke proof enclosures by PFC 403.5.4 which is discussed further in the Smoke Control and Management Systems section.

ELEVATOR LOBBY
The elevator lobby enclosure is required to have a minimum fire resistance rating of 2-hours.

INTERIOR AND EXTERIOR AREAS OF REFUGE
Areas of refuge are located in stairwell 2 and 4 on each of the tower floors per 1007.6. It is located in the stairwell and requires a 2-hour fire resistance rating. There is one exterior area of refuge located in stairwell 1 and 3 on each of the tower floors per 1007.7. It is located in the stairwell and has a 2-hour fire resistance rating. The exterior area of refuge is required to be at least 50% open to the air.

OCCUPANCY SEPARATIONS

This section describes the fire resistive ratings of barriers which separate adjacent spaces. Penetration protection for these barriers is addressed.

TABLE 6. REQUIRED FIRE SEPARATION OF OCCUPANCIES - PBC TABLE 508.3.3

	A[e], E		I		R[d]		F-2, S-2[c,d]		B[b], F-1, M[b], S-1		H-1		H-2		H-3, H-4, H-5	
OCCUPANCY	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A[e], E[e]	N	N	1	2	1	2	N	1	1	2	NP	NP	3	4	2	3[a]
I	—	—	N	N	1	NP	1	2	1	2	NP	NP	3	NP	2	NP
R[d]	—	—	—	—	N	N	1	2	1	2	NP	NP	3	NP	2	NP
F-2, S-2[c,d]	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3[a]
B[b], F-1, M[b], S-1	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2[a]
H-1	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP
H-3, H-4, H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

For SI: 1 square foot = 0.0929 m².
S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not permitted.
a. For Group H-5 occupancies, see Section 903.2.4.2.
b. Occupancy separation need not be provided for storage areas within Groups B and M if the:
1. Area is less than 10 percent of the floor area;
2. Area is equipped with an automatic fire-extinguishing system and is less than 3,000 square feet; or
3. Area is less than 1,000 square feet.
c. Areas used only for private or pleasure vehicles shall be allowed to reduce separation by 1 hour.
d. See Section 406.1.4.
e. Commercial kitchens need not be separated from the restaurant seating areas that they serve.

Occupancy separations due to the local code PBC 508.3.2 and Table 6. The assembly area (A-2, A-3) and the office (B) areas do not require any separation. The café and the resident assistant suites are separated by an exit corridor with 1-hour fire resistive construction. The loading dock does not require separation from the adjacent areas (A-2.1 and B). Appropriate opening protection is provided as required by Code.

OTHER SEPARATIONS

Transformers are to be separated by 2-hour construction. Elevator lobbies have 20-minute opening protection on all floors, except for the ground floor which is open to the public circulation area. This is a vertical shaft over 4 stories.

The fire command center, shall be separated from the remainder of the building by not less than a 1-hour fire-resistive occupancy separation. Through penetrations and membrane penetrations are protected as required by code with a UL listed fire resistive product. Fire Dampers are located where ducts penetrate a fire resistant partition or wall. Fire dampers shall be rated at 286 °F.

A refuse chute is provided extending from the 13th floor to the ground level with a shaft enclosure fire resistance rating of 2-hours per PBC Section 713.4, spring loaded doors, and opening protectives fire resistance rating of 1-hour per PBC section 713.13

b. SMOKE DAMPERS

Smoke dampers are to be located where ducts penetrate elevator lobbies, rated corridor walls, and all other smoke zone boundary walls. They are activated by both smoke detection (as documented on the fire alarm matrix) and fixed temperature. The smoke dampers have a minimum leakage rating of Class III and fail in the closed position.

c. OPENING FIRE PROTECTION ASSEMBLIES, RATINGS, AND MARKINGS
Openings in protective assemblies are follow the requirements of Table 7 from PBC Section 716.

TABLE 7. OPENING PROTECTIVE REQUIREMENTS FROM PBC TABLE 716.5

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANELSIZE	FIRE RATED GLAZING MARKING DOOR VISION PANEL[e]	MINIMUM SIDELIGHT/ TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELITE/TRANSOM PANEL	
					Fire protection	Fire resistance	Fire protection	Fire resistance
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4	3	Not Permitted	Not Permitted	Not Permitted	4	Not Permitted	W-240
	3	3[a]	Not Permitted	Not Permitted	Not Permitted	3	Not Permitted	W-180
	2	$1\frac{1}{2}$	100 sq. in.[c]	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	2	Not Permitted	W-120
	$1\frac{1}{2}$	$1\frac{1}{2}$	100 sq. in.[c]	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	$1\frac{1}{2}$	Not Permitted	W-90
Shaft, exit enclosures and exit passageway walls	2	$1\frac{1}{2}$	100 sq. in.[c, d]	≤100 sq.in. = D-H-90 > 100 sq.in.= D-H-T-or D-H-T-W-90	Not Permitted	2	Not Permitted	W-120
Fire barriers having a required fire-resistance rating of 1 hour: Enclosures for shafts, exit access stairways, exit access ramps, interior exit stairways, interior exit ramps and exit passageway walls	1	1	100 sq. in.[c, d]	≤100 sq.in. = D-H-60 >100 sq.in.= D-H-T-60 or D-H-T-W-60	Not Permitted	1	Not Permitted	W-60
					Fire protection			
Other fire barriers	1	$\frac{3}{4}$	Maximum size tested	D-H-NT-45	$\frac{3}{4}$		D-H-NT-45	
Fire partitions: Corridor walls	1	$\frac{1}{3}$[b]	Maximum size tested	D-20	$\frac{3}{4}$[b]		D-H-OH-45	
	0.5	$\frac{1}{3}$[b]	Maximum size tested	D-20	$\frac{1}{3}$		D-H-OH-20	
Other fire partitions	1	$\frac{3}{4}$	Maximum size tested	D-H-45	$\frac{3}{4}$		D-H-45	
	0.5	$\frac{1}{3}$	Maximum size tested	D-H-20	$\frac{1}{3}$		D-H-20	

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE	FIRE RATED GLAZING MARKING DOOR VISION PANEL[e]	MINIMUM SIDELIGHT/ TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELITE/TRANSOM PANEL	
					Fire protection	Fire resistance	Fire protection	Fire resistance
Exterior walls	3	$1\frac{1}{2}$	100 sq. in.[c]	≤ 100 sq.in. = D-H-90 >100 sq.in = D-H-W-90	Not Permitted	3	Not Permitted	W-180
	2	$1\frac{1}{2}$	100 sq. in.[c]	≤100 sq.in. = D-H-90 >100 sq.in.= D-H-W-90	Not Permitted	2	Not Permitted	W-120
					Fire Protection			
	1	$\frac{3}{4}$	Maximum size tested	D-H-45	$\frac{3}{4}$		D-H-45	
Smoke barriers					Fire protection			
	1	$\frac{1}{3}$[b]	Maximum size tested	D-20	$\frac{3}{4}$		D-H-OH-45	

For SI: 1 square inch = 645.2 mm.
a. Two doors, each with a fire protection rating of $1\frac{1}{2}$ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection
b. For testing requirements, see Section 716.6.3.
c. Fire-resistance-rated glazing tested to ASTM E 119 in accordance with Section 716.2 shall be permitted, in the maximum size tested.
d. Except where the building is equipped throughout with an automatic sprinkler and the fire-rated glazing meets the criteria established in Section 716.5.5.
e. Under the column heading "Fire-rated glazing marking door vision panel," W refers to the fire-resistance rating of the glazing, not the frame.

INTERIOR FINISH, DECORATIVE MATERIALS AND FURNISHINGS

This section describes how the facility complies with PBC Chapter 8 to reduce flame spread and smoke development due to wall, ceiling and floor finishes, as well as insulating materials.

INTERIOR WALL AND CEILING FINISHES

In new and existing buildings, interior finishes must meet the requirements of PFC Chapter 8 based on occupancy as described in Table 8. Ground floor occupancies are primarily having an assembly function with large groups of people requiring a more restrictive requirement. Interior finish requirements are based on the Table and exceptions below from PFC Section 803 in a sprinklered building.

TABLE 8. INTERIOR WALL AND CEILING FINISH REQUIREMENTS – PBC TABLE 803.3

GROUP	SPRINKLERED[l]			NONSPRINKLERED		
	Interior exit stairways and interior exit ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces[c]	Interior exit stairways and interior exit ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces[c]
A-1 & A-2	B	B	C	A	A[d]	B[e]
A-3[f], A-4, A-5	B	B	C	A	A[d]	C
B, E, M, R-1, R-4	B	C	C	A	B	C
F	C	C	C	B	C	C
H	B	B	C[g]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[h, i]	A	A	B
I-3	A	A[j]	C	A	A	B
I-4	B	B	B[h, i]	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No Restrictions			No Restrictions		

Floor finish in the new building is required to follow PFC 804.3 unless it is a traditional type such as wood, terrazzo, vinyl, or a material not comprised of fibers. Foam plastic insulation is required to have a minimum density of 20 pounds per cubic foot, a maximum ½ inches thickness, and maximum width of 8 inches. Flame spread is limited to 75 in accordance with ASTM E 84 and UL 273.

UPHOLSTERED FURNITURE AND MATTRESSES

In group R-2 occupancies, new upholstered furniture is required to resist ignition by cigarettes as tested in accordance with NFPA 261 and/or Class I requirements in accordance with NFPA 260. Upholstered furniture must have a limited heat release rate of 80kW when tested in accordance with ASTM E 1537 or California Technical Bulletin 133. ASU requires all furniture meet either California Technical Bulletin 133 and/or California Technical Bulletin 117. The furniture provided meets the requirements put forth by ASU and complies with California Technical Bulletin 117 and/or 117.

CA TB 117 California has been used since 1975. It was recently revised from an open flame test to a smoldering ignition source test in January 2015. This test is performed on components and the piece of furniture can carry the rating when composed of these materials. By comparison, CA TB 133 is a test of the furniture assembly as a whole. This topic is discussed in more detail in the Performance Based Section.

DECORATIVE STRUCTURES WITHIN BUILDINGS

This section described the fire protection aspects of decorative structures located within buildings. There are no plans for decorative art at this time.

CONCLUSION (FIRE RESISTANT AND SMOKE RESISTANT ASSEMBLIES)

Based on a prescriptive evaluation of the building, it is in conformance with the 2012 International Building Code and 2012 International Fire Code with respect to the fire resistant assemblies in the Taylor Place design.

8. SPECIAL DESIGN

INTRODUCTION

This section is dedicated to architectural features that have specific requirements based on the construction. The section on Atriums below is a good example where the feature almost takes on a life of its own.

ATRIUMS

Where atriums are used, there must be an added degree of safety to the occupants due to the large volume of space into which smoke can be dissipated. There are no atriums located in the North or South tower. The community space located in the South Tower is considered a two story vertical opening per PBC section 712.18 and is not an atrium per section PBC 404.

VERTICAL OPENING

The upper level of the Community Area in the South Tower is not defined as a mezzanine because it is part of the floor above. Mezzanines are considered part of the story below and regulated by section 505 in the PBC. There are seven specific requirements the space must comply with to be called a two-story opening:

1. Does not connect more than two stories.
2. Does not contain a stairway or ramp required by PFC Chapter 10.
3. Does not penetrate a horizontal assembly that separates fire areas or smoke barriers that separate smoke compartments.
4. Is not concealed within the construction of a wall or a floor/ceiling assembly.
5. Is not open to a corridor in Group I and R occupancies.
6. Is not open to a corridor on non-sprinklered floors.
7. Is separated from floor openings and air transfer openings serving other floors by construction conforming to required shaft enclosures.

The common areas comply with all of these requirements except for the item 5. The upper and lower floor are currently connected to corridors and the building is an R occupancy. This portion of the design does not meet the requirement of the PBC, and a performance issue is presented later. The corridors may need to be isolated from the two-story space unless the validation of the design is proven to maintain tenability.

CONCLUSION (SPECIAL DESIGN)

Based on a prescriptive evaluation of the building, the vertical openings in the south tower are not in compliance with the 2012 International Building Code and 2012 International Fire Code. The two-story vertical opening is connected to the corridors on two floors. This non-compliance will be discussed later in the performance-based analysis.

9. ELEVATOR SYSTEMS

INTRODUCTION

This section describes all emergency and fire protection aspects of the elevators. Five elevators are provided in the South Tower. One freight elevator provides service between the ground floor and basement. The remaining elevators are arranged in a bank of four providing access to floors 1 through 13. The tower elevators are gearless traction type with non-combustible cars and electrical drive systems. The basement elevator is a hydraulic elevator.

ELEVATOR REQUIREMENTS

Shaft protection is required per PBC section 3002 Hoistway Enclosures. All elevator hoist ways are of 2-hour construction and the elevator door provides a 1 hour opening protection. At least one elevator is sized to accommodate an ambulance stretcher.

Four elevators are provided to serve the two towers. All elevators shall automatically transfer to secondary power source on power failure. If power is insufficient to power all elevators, they are required to be returned to the designated level one at a time.

Hoistway venting is not required by PBC 3004.1 Exception 1 in an R-2 occupancy when the building is fully sprinklered.

Elevator Lobbies are provided at all levels except for the ground floor. Elevators open into a 1-hour fire-rated vestibule with walls from slab to slab. All vestibule doors are 20-minute fire-rated smoke and draft assemblies and are held open by magnetic door releases actuated by smoke detection. Each elevator lobby is provided with approved smoke detector(s) installed in accordance with their listings. Combination fire/smoke dampers are installed on all HAVC ducts which penetrate lobby walls. Regardless of whether the elevators are under primary or secondary power, activation of a lobby, or machine room smoke detector initiates Phase I automatic recall of all elevators serving that bank to return nonstop to the ground floor.

If detection is on the ground floor:

- Guestroom tower elevators (Nos. 1 through 4) return to the third floor
- The service elevator (No. 5) returns to the ground floor

Fire and Emergency Elevator

- Requirements in PBC section 3007, Fire Service Access Elevator
- The main elevator (No. 4) which accesses all levels is available for fire and emergency use. It provides access to the ground floor corridor near the Fire Command Center.
- The emergency elevator is designated by a permanent sign on the elevator status panel in the Fire Command Center.
- The size of the emergency elevator is able to accommodate a 24-inch by 76-inch stretcher in its horizontal position. A minimum clear opening width of 42-inches is provided.

Manual Overrides

- For Emergency Fire Fighter Operation, Phase I emergency recall and Phase II in-car operation per PBC section 3003.2.
- A three-position (on/off/bypass) key-operated switch is provided at grade level for each

bank of elevators for emergency override.

- A two-position (on/bypass) key-operated switch is provided inside each elevator cab.
- Elevator Keys are provided for Fire Department use in case of emergency in a lockable cabinet in the Fire Command Center (FCC).
- Each elevator machine room is provided with approved smoke detector(s) installed in accordance with their listings.

CONCLUSION

Based on a prescriptive evaluation of the elevator, it is in accordance with Applicable Codes as identified earlier in this document.

10. FIRE PROTECTION AND LIFE SAFETY SYSTEMS

INTRODUCTION

This section discusses the systems that comprise the fire sprinkler, fire alarm, and life safety systems such as smoke control, emergency communications, and emergency power. It focuses on how these systems are supplied, there required functions, and how they are tested. Fire department access and features are also discussed.

SUMMARY

Taylor Place is protected by a fully automatic sprinkler system. The system is supplied with water from the City of Phoenix city by two connections to a city main under 2nd street. Due to the height of the building, an electric fire pump is planned to boost water pressure to supply the higher floors.

Standpipes are provided in each stairwell with two standpipes serving as combination wet risers and standpipes. Sprinkler systems are supplied from the main fire pump room on the ground floor through the wet standpipe through floor control valves on each floor similar to Figure 4 with a control and check valves, pressure gage, waterflow switches, and testing trim. Two fire department connections are provided, one on each tower.

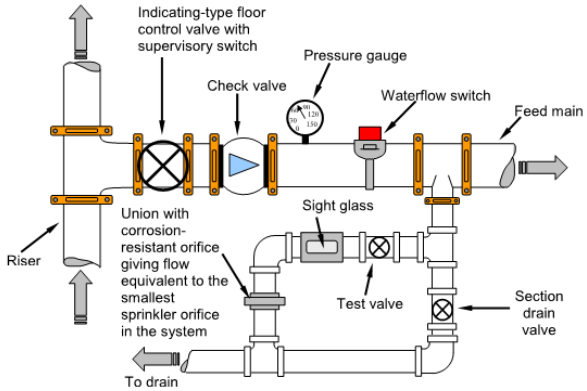

FIGURE 4. TYPICAL FLOOR CONTROL VALVE

Water flow switches and tamper switches are provided and monitored by the fire alarm system to identify the location of an alarm, and notify building security if valves have been tampered with intentionally. An exterior diesel generator is planned to provide emergency power to the fire pump, lighting, and other building systems.

A fire command center per PBC 403.4.6 is located on the ground floor in the south tower near the security desk. An emergency voice communication system capable of broadcasting pre-recorded messages and live voice messages in located in the fire command center. A water flow or manual pull station initiates the fire alarm system. Smoke detection consisting of area and duct detection in non-residential areas triggers a supervisory alarm. Smoke detection in residential and sleeping areas is multi-station smoke detection utilizing 520 Hz sounder bases for audible notification triggering a supervisory alarm. Speaker strobes throughout the building provide visual and audible notification in all spaces.

The system is monitored by the 24-hour security guard from the desk in the south tower on the ground floor. A fire annunciator panel and local operator console (LOC) are provided at the security desk for public access to the LOC.

The building is built to current International codes with proper fire resistant construction, dampers, fire doors, and self-closing doors in the residential floors.

INFRASTRUCTURE

(SUPPORTING BUILDING FIRE PROTECTION AND LIFE SAFETY SYSTEMS)

WATER SUPPLY

Water is supplied to the building from a 16” city water main that runs underneath N. 2nd St.

Water is supplied to the Fire Protection System through an 8" pipe, a buried control valve with a curb box, and then connects to the fire pump supply.

Static Pressure = 60 psi
Residual Pressure = 50 psi
Flow available is approximately 1200 gallons per minute.

A water flow test is required within 6 months prior to the submittal of detail sprinkler design.

FIRE FLOW AVAILABLE

Per Phoenix Fire Code, Appendix B, section B104.3 the area of three successive floors is used as the area for the fire flow calculation. The largest floor is 9,750 square feet providing a fire flow calculation area of 29,250 square feet. Per Table 9, the required flow is 1,750 gallons per minute. The available fire flow at 20 psi is 2,537 gallons per minute and is adequate.

TABLE 9. MINIMUM REQUIRED FIRE-FLOW AND DURATION FOR BUILDINGS FROM PFC TABLE B105.1

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	2
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	

FIRE MAIN AND FIRE HYDRANT LOCATIONS

The municipal city water mains run east and west along Taylor place and north and south along 1st Street. There are two fire hydrants located on the north side of E Taylor Street and on the west side of N 1st Street. The fire department connections are located on the northeast stair standpipe and near the south tower main entrance on E Taylor Street.

FIRE WATER STORAGE TANK

No fire protection water storage tanks are provided.

UTILITIES

All utilities enter the building from the east along N 2nd Street. Electrical transformers are located on the east side of the property. A diesel generator is located to the north east of the property and is discussed later in more detail. Natural gas enters the property from the east to supply the hot water heater and kitchen equipment.

SITE ACCESS FOR EMERGENCY RESPONSE

This section describes the Fire Department Access requirements prescribed by the Phoenix Fire Codes, which are incorporated into this facility.

FIRE DEPARTMENT EMERGENCY ACCESS

The site plan, fire department access, and other fire features are shown in Figure 5. Access to the south corridor and fire pump room is provided for the fire department on the east side of South Tower near the intersection of N. 2nd St. and E. Taylor St shown in Figure 6. This access point allows the Fire Department access to the fire pump room, control valves, and the egress corridor between the assembly, rear mercantile exits with access to the basement stair and freight elevator.

Additional access is provided on the south side of South Tower along E Taylor St. to the security station, local operator's console, and fire command center. This area also provides access to the emergency elevators for the North and South Tower.

Fire department connections (FDC) are provided in two locations. The first connection is shown in Figure 7 and located at the main entrance on E. Taylor St. on the south side of South Tower. This connection serves the South tower sprinkler systems. The second FDC is shown in Figure 8 and located at the Northeast side of North Tower near N. 2nd St. These connections serve all building systems.

Ground level exterior access to the stairwells is provided at the base of each stair.

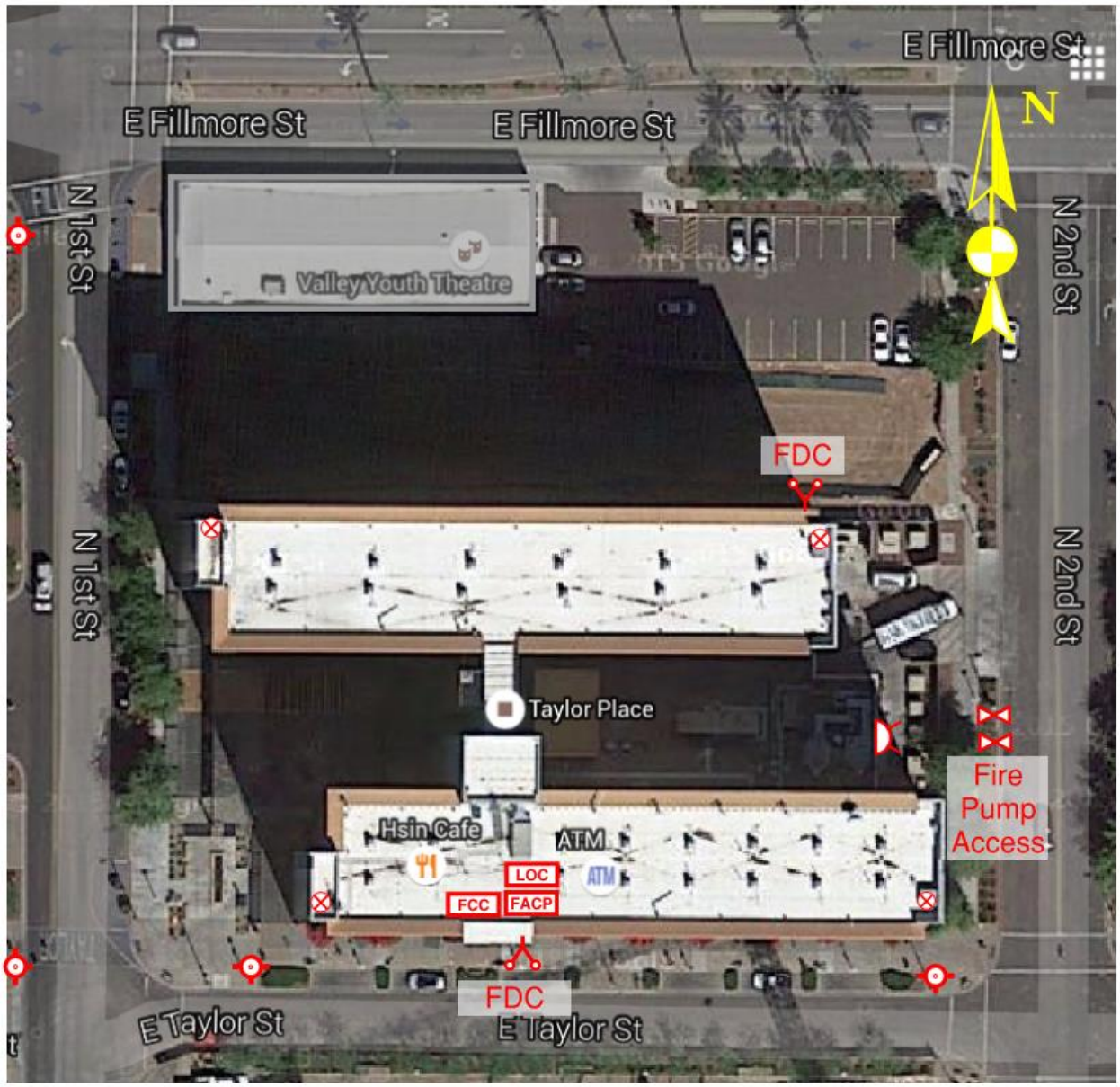

FIGURE 5. SITE PLAN AND FIRE DEPARTMENT ACCESS

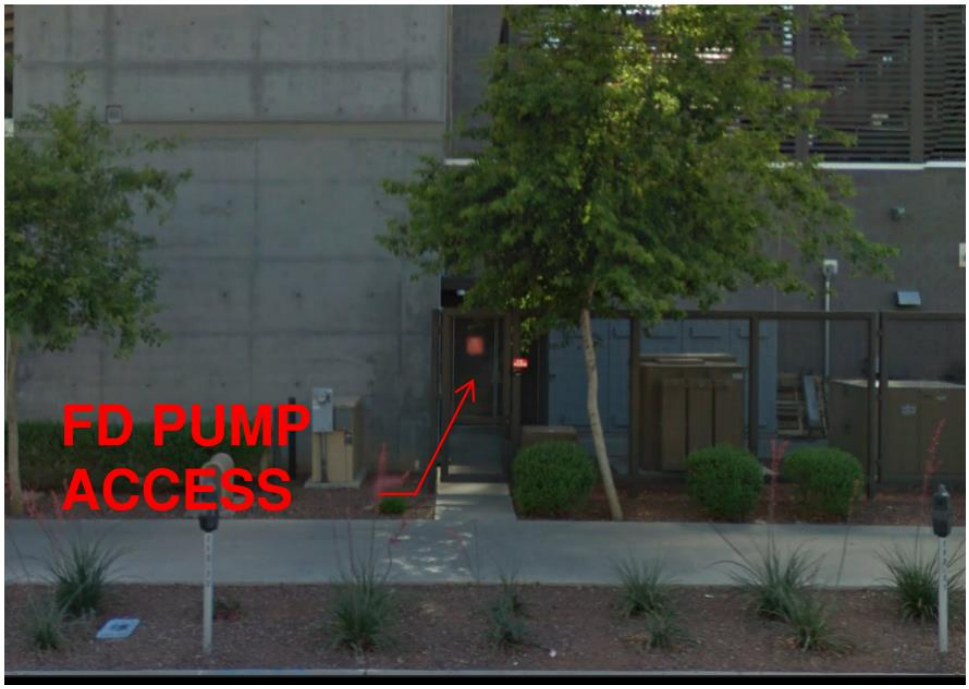

FIGURE 6. FIRE DEPARTMENT ACCESS TO FIRE PUMP - N 2ND ST.

FIGURE 7. FIRE DEPARTMENT ACCESS AND CONNECTION – E. TAYLOR ST.

FIRE COMMAND CENTER (FCC)

This Fire Command Center (FCC) is required by PFC Section 911, which acts as a command center during fire Department emergency operations. The Security desk, annunciator panel, and local operator console are located on the ground floor level on the South side of the building as indicated in Figure 5 through the door in Figure 8. The FCC door is interior of the South entrance with a Knox box located on the exterior wall. The FCC is required to be separated from the remainder of the building by not less than a one-hour fire-resistive separation. It is required to be at least 96 square feet of floor area with a minimum dimension of 8 feet. Annunciation of all active fire protection systems is provided at the FCC and Security desk. Details of all annunciation and control panels to be installed in the Central Control Station are to be submitted to the Fire Department for review and approval prior to installation.

FIGURE 8. FIRE DEPARTMENT ACCESS AND CONNECTION

FIRE FIGHTER'S AIR CONTROL SYSTEM (FFAS)

As required by section 915 of the Phoenix Fire Code, fire fighter air systems are required for high rises in accordance with the fire code. The systems are required to allow fire fighters to fill their standard cylinders within 2 minutes at two different locations simultaneously. The cylinder filling panels are provided at each landing of each stairwell.

ACCESS CONTROLLED DOORS

Access controlled egress doors are provided at the rear of the mercantile shops located along Taylor Street. These doors are operable from the interior of the mercantile shops for egress, but entry is controlled from the corridor. The main entrance and elevators require access control cards.

FIXED FIRE SUPPRESSION SYSTEMS

This section describes all fire suppression aspects incorporated into the facility. Their interrelation with other active and passive fire protection features is also addressed.

AUTOMATIC SPRINKLER PROTECTION

A wet-pipe, hydraulically calculated automatic sprinkler systems is provided throughout the entire building. No dry pipe sprinklers are to be used. Exterior exposed piping is to be designed as required by PFC 903.3.5.4.

Automatic sprinkler systems are designed to comply with the PFC and City of Phoenix amendments, and NFPA 13. Automatic sprinkler zones are designed to coordinate with fire alarm zones. The maximum area per sprinkler zone on any floor does not exceed 52,000 square feet for Light Hazard and Ordinary Hazard per NFPA 13:8.2.1.

The basement is provided with drains and a sump pump to remove fire sprinkler water to avoid a flood risk in a sprinkler discharge. The pump is sized to remove water at a rate equal to the sprinkler design plus 10% and powered by the backup generator.

No mechanical smoke control systems are anticipated.

Floor are provided with a pressure reducing valve on the floor control supply assembly to each floor, if required. It is provided to reduce the water pressure from the pump.

FIRE PROTECTION OCCUPANCY CLASSIFICATIONS

The **Basement** is classified as **Ordinary Hazard Group 2** per NFPA 13:5.3.2. The area shown in Figure 9 is characterized by mechanical equipment and maintenance areas containing chill water pumps, chillers, water pumps, boilers/water heaters, supplies, and limited combustible liquids stored in fire cabinets. The areas fit the definitions of Ordinary Hazard, Group 1 and 2 due to machine shops, chemical plants (ordinary), machine shops, repair garages, where per NFPA 13:5.3.2.1 quantity and combustibility of contents are moderate to high and stockpiles with moderate heat release do no exceed 8 feet. An enlarged legend is provided in Figure 11. There is limited storage allowed in the basement. Storage typically consists of maintenance supplies, filters, belts, lubrication, oils, hoses, machine parts, raw metal, and misc. equipment.

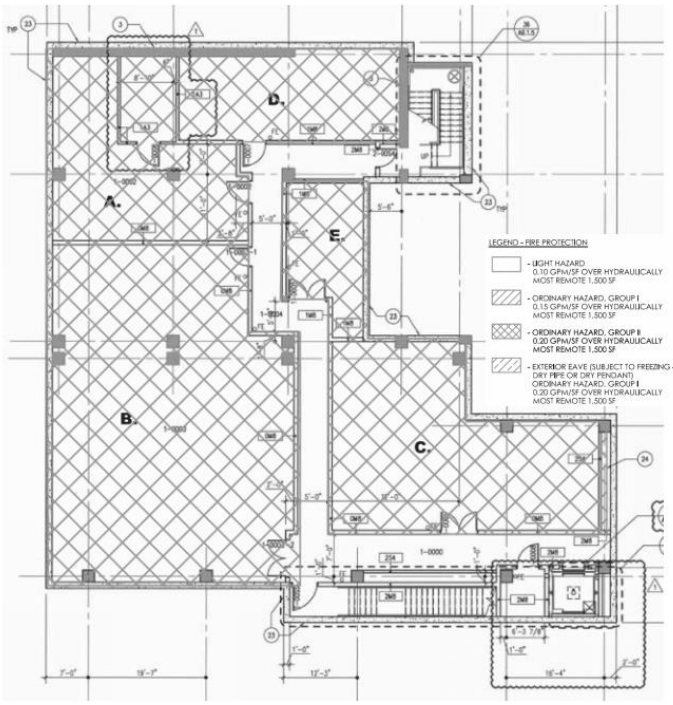

FIGURE 9. BASEMENT OCCUPANCY CLASSIFICATIONS (North is up)

The following **Ground floor** areas are classified as **Light Hazard** per NFPA 13:5.3.1 and shown in Figure 10 with an enlarged legend in Figure 11.

- Four small residential apartments for the resident assistants.
- Offices for support staff at the dormitory and a mailroom.
- Assembly and cafeteria between Towers 1 and 2.

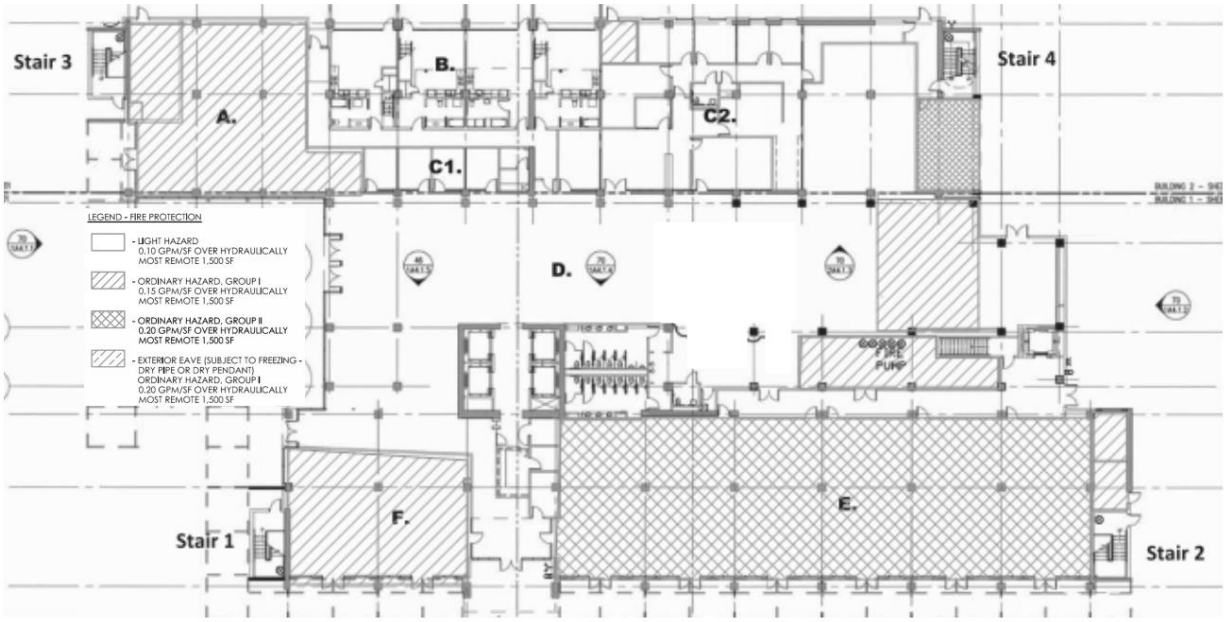

FIGURE 10. GROUND FLOOR OCCUPANCY CLASSIFICATIONS (North is up)

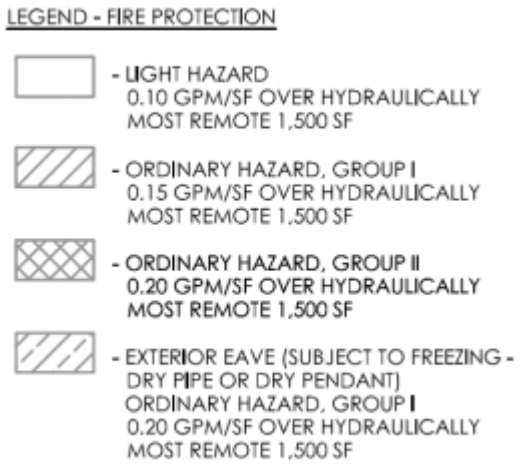

FIGURE 11. OCCUPANCY CLASSIFICATIONS LEGEND

The following **Ground floor** areas are classified as **Ordinary Hazard Group 1** per NFPA 13:5.3.2:

- The Café at the west side of North Tower. It is a small restaurant with service areas, a small kitchen, and also acts as a bakery.
- The cafeteria, kitchen, loading dock, and trash compactor at the east side of the assembly area
- The coffee shop located below the south tower

The following **Ground floor** areas are classified as **Ordinary Hazard Group 2** per NFPA 13:5.3.2:

- Six future suites on the south side of South Tower for business or mercantile shops with street access. Per NFPA, the greatest potential hazard is Mercantile so these areas are classified as OH Group 2.
- A restaurant occupies this area but the conservative classification remains Mercantile.

The following **North and South Tower** areas are classified as **Light Hazard** per NFPA 13:5.3.1 and shown in Figure 12:

- The residential dormitories for students occupying the two towers.

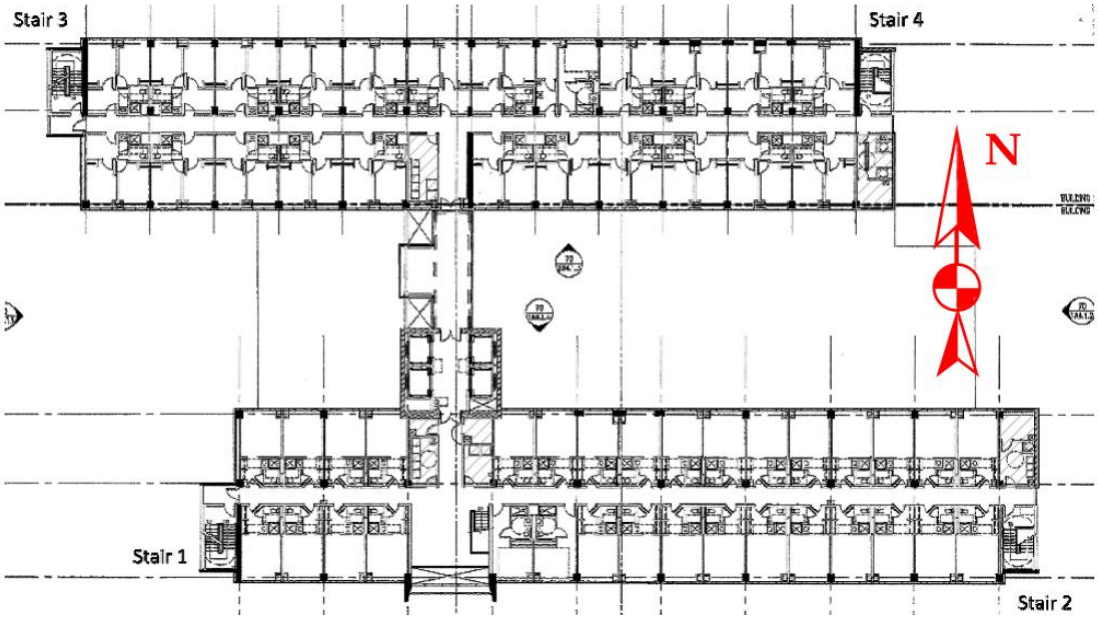

FIGURE 12. TYPICAL NORTH AND SOUTH RESIDENTIAL TOWER

SPRINKLER SYSTEM DESIGN SUMMARY

Table 13 summarizes the sprinkler designs chosen for the project. The occupancy class and design areas determined by using the procedures in NFPA 13 Chapter 11 and 23 and the hydraulic demand for the systems was calculated initially by hand and then by using a computer based hydraulic calculation software. Of the designs below, the Basement, Ground Floor Café, and South Tower were chosen to be hydraulically calculated and included in this report. The calculations are located in the Appendix I.

TABLE 13. SPRINKLER SYSTEM DESIGN SUMMARY

Location of Remote Area	Occupancy Class	Design Area	Demand Pump Discharge (gpm@psi)	Duration (minutes)	Inside/ Total Hose (gallons per minute)
Basement	OH2	1500	439 gpm@71.6psi	60-90	0/250
Ground Floor Café	OH1	1080	264.8 gpm@47.8psi	60-90	0/250
North Tower	LH	Room + Corridor	242.7 gpm @ 103.8	30-60	0/100

COMMODITY CLASSIFICATIONS

Per NFPA 13:5.6.3 and the associated Appendix Tables, the building contains several commodities as identified in Table 11 below.

TABLE 10. COMMODITY CLASSIFICATIONS BY AREA

Basement	Class I	Batteries, metal desks, electric motors, cans, transformers, and other common items
	Class II	Light fixtures, wiring, plastic containers, appliances, non-flammable liquids, and wood products
	Class III	Aerosols, furniture, paper rags, textiles, and PVC
	Class IV	Rubber, synthetic textiles, wiring, oil based paints, vinyl floor coverings, and corrugated cartons
	Plastic Rubber	Materials to maintain the facility equipment (chillers, pumps, boilers, etc….) This included commodities in both group A and B groups including items like batteries, plastic containers, rubber and plastic.
Ground floor	Class I	Batteries, metal desks, appliances, nuts, milk, canned foods all in limited quantities
	Class II	Light fixtures, wiring, plastic containers, appliances, non-flammable liquids, and wood products
	Class III	Cloth, furniture, paper rags, textiles, and PVC mostly in small quantities
	Class IV	Rubber, synthetic textiles, rayon (clothing), vinyl floor coverings, wood furniture, and corrugated cartons. There is a heavy concentration of textiles in the mercantile areas/clothing stores
	Plastic Rubber	Restaurants supplies to provide services. This includes commodities primarily in group A including items like batteries, plastic containers, paper products, stuffed toys, margarine, milk and beverages in plastic containers.
Ground floor	Class I	Batteries, metal desks, appliances, nuts, milk, canned foods all in limited quantities
	Class II	Light fixtures, wiring, plastic containers, appliances, and foods all in limited quantities.
	Class III	Cloth, furniture, paper rags, textiles, PVC, and mattresses in small quantities
	Class IV	Including rubber, synthetic textiles, rayon (clothing), vinyl floor coverings, and wood furniture, in small quantities
	Plastic Rubber	Electronics, batteries, plastic containers, paper products, stuffed toys, margarine, milk and beverages in plastic containers.

SPRINKLER SYSTEM DESIGN

Sprinkler System Design is based on NFPA 13 *Standard for the Installation of Sprinkler Systems*. Hydraulic designs are based on the occupancy hazard fire control approach and classification using the hydraulic method where appropriate. The detailed sprinkler design is typically deferred per PBC 107.3.4, but is detailed here as much as possible for the report based on the floor plans. Typically, performance specification and drawings are provided by the design professional in responsible charge. The detailed design is performed by a NICET designer to the performance requirements and submitted to the design professional in responsible charge for review. Sprinkler installation does not proceed without approval from the design professional in responsible charge.

Design density is provided by Figure 13 from NFPA 13:

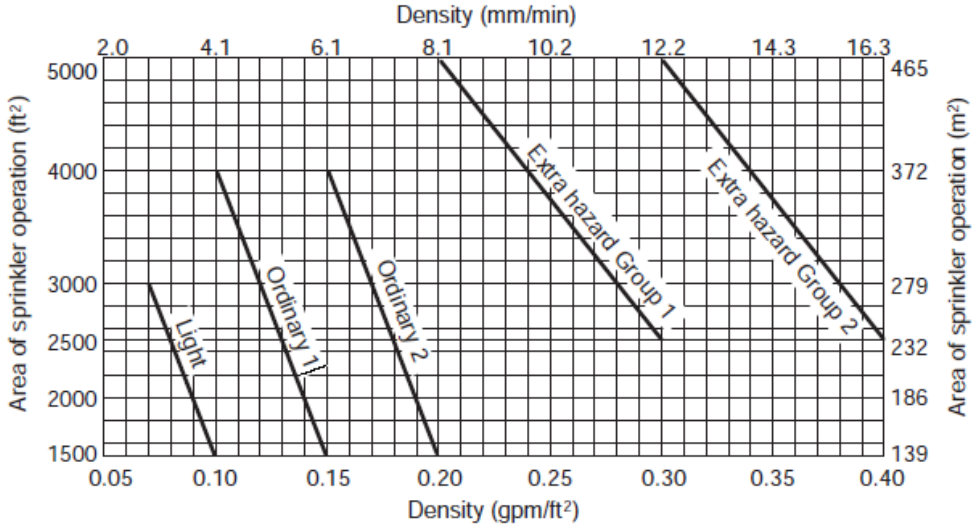

FIGURE 13. DENSITY/AREA CURVES - FIGURE 11.2.3.1.1 FROM NFPA 13

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And hose allowance requirements are provided by Table 12 from NFPA 13:

TABLE 12. HOSE STREAM ALLOWANCE AND WATER SUPPLY DURATION REQUIREMENTS - TABLE 11.2.3.1.2 FROM NFPA 13

Occupancy	*Inside Hose*		*Total Combined Inside and Outside Hose*		*Duration (minutes)*
	gpm	*L/min*	*gpm*	*L/min*	
Light hazard	0, 50, or 100	0, 189, or 379	100	379	30
Ordinary hazard	0, 50, or 100	0, 189, or 379	250	946	60–90
Extra hazard	0, 50, or 100	0, 189, or 379	500	1893	90–120

Minimum and maximum spacing of sprinkler was based off Table 13 below from NPFA 13:8.6 for Light Hazard. Ordinary Hazard protection area of 130 square feet and maximum spacing of 15 feet are provided by NFPA 13 Table 8.6.2.2.1(b) which is not shown.

TABLE 13. PROTECTION AREAS AND MAXIMUM SPACING OF SPRINKLERS FOR LIGHT HAZARD – TABLE 8.6.2.2.1(a) FROM NFPA 13

Construction Type	*System Type*	*Maximum Protection Area*		*Maximum Spacing*	
		ft²	*m²*	*ft*	*m*
Noncombustible unobstructed	Hydraulically calculated	225	20.9	15	4.6
Noncombustible unobstructed	Pipe schedule	200	18.6	15	4.6
Noncombustible obstructed	Hydraulically calculated	225	20.9	15	4.6
Noncombustible obstructed	Pipe schedule	200	18.6	15	4.6
Combustible unobstructed with no exposed members	Hydraulically calculated	225	20.9	15	4.6
Combustible unobstructed with no exposed members	Pipe schedule	200	18.6	15	4.6
Combustible unobstructed with exposed members 3 ft (0.91 m) or more on center	Hydraulically calculated	225	20.9	15	4.6
Combustible unobstructed with exposed members 3 ft (0.91 m) or more on center	Pipe schedule	200	18.6	15	4.6
Combustible unobstructed with members less than 3 ft (0.91 m) on center	All	130	12.1	15	4.6
Combustible obstructed with exposed members 3 ft (0.91 m) or more on center	All	168	15.6	15	4.6
Combustible obstructed with members less than 3 ft (0.91 m) on center	All	130	12.1	15	4.6
Combustible concealed spaces in accordance with 8.6.4.1.4	All	120	11.1	15 parallel to the slope 10 perpendicular to the slope*	4.6 parallel to the slope 3.05 perpendicular to the slope*

*See 8.6.4.1.4.4.

REMOTE AREAS

a. BASEMENT

The basement is a collection of small mechanical, maintenance, and storage areas. The largest area is approx. 1,500 square feet which is the area of the largest demand. Tyco quick response K8.0 sprinklers were selected.

The sprinkler design for this area is Ordinary Hazard Group 2 - 0.2 gallons per minute per 1500 square feet based on the occupancy classification and the NFPA 13 Figure 11.2.3.1.1. An additional reduction in overall design area per NFPA 13:11.2.3.2.3, due to quick response sprinklers was rejected due to potential unprotected ceiling pockets.

The sprinklers specified are:

TYCO PENDANT QUICK RESPONSE (TY4231) Standard Spray K8.0/155˚ F

As (square feet)	Qs (gpm)	L (feet)	A / As
130	26	46.5 x 32.2	12

Based on room layout and spacing 13 heads were used to achieve 1500 square feet remote area. This system is fed by a feed main in the protected corridor from the system riser in the pump room. A smaller cross main will feed the branch lines and sprinklers.

b. GROUND FLOOR

The café is a small restaurant/bakery with a limited seating area. This area can be modified in the future for a new occupancy. Tyco quick response K8.0 sprinklers were selected. Based on the occupancy classification and the above Figure, a design was chosen using the density area method. Per NFPA 13:11.2.3.2.3, an additional reduction in overall design area due to quick response sprinklers was accepted.

The sprinkler design for this area is Ordinary Hazard Group 2 - 0.2 gallons per minute per 1080 square feet based on the occupancy classification and the NFPA 13 Figure 11.2.3.1.1. An additional reduction in overall design area per NFPA 13:11.2.3.2.3 was taken.

The sprinklers specified are:

	TYCO PENDANT QUICK RESPONSE (TY4231) Standard Spray K8.0/155˚ F			
T Y	As (square feet)	Qs (gallons per minute)	L (feet)	A / As
	130	26	39.4 x 27.4	9 (8.3)

The Café remote area is fed from a feed main from the system riser in the pump room. This feed main supplies the other areas on the main floor. The cross main for the system remains and feeds branch lines. This pipe size could be reduced in the café area, but was increased to reduce friction loss.

c. DORMITORY SOUTH TOWER

The dormitory South Tower rooms consist of one-bedroom apartment with kitchenette. The bathrooms are unprotected based on NFPA 13, Section 8.15.8.1 and the small size of the bathrooms of 35 square feet which is considerably less than the required 55 square feet as an equivalency. The room design method was employed here due to the individual rooms. The rooms were built with fire resistant walls equal to the water supply duration per NFPA 13:11.2.3.3. Five sprinklers in the corridor were added to the design per NFPA 13:11.2.3.3.6 in the event the fire spreads into the corridor.

The sprinkler design for this area is Light Hazard - 0.1 gallons per minute per 600 square feet based on the occupancy classification and the above Figure, a design was chosen using the density area method. Per NFPA 13:11.2.3.2.3, an additional reduction in overall design area due to quick response sprinklers was rejected due to potential unprotected ceiling pockets.

The sprinklers specified were:

T Y C	TYCO PENDANT (TY3231) QUICK RESPONSE Standard Spray K5.6/155˚ F			
	As (square feet)	Qs (gpm)	L (feet)	A / As
	126	25.2	39.4 x 27.4	9 (8.3)

Per NFPA13: 23.4.4.1.1.1, the remote area is based on one dorm room plus five sprinklers in the corridor. For the other heads the maximum spacing was used due to limited space and combustibles. Corridor sprinklers covered roughly 40 square feet and the kitchen sprinklers covered approx. 40 square feet.

The South Tower remote area is fed thru a feed main from the system riser in the pump

room. This feed main is run to the south east stair standpipe and then thru a floor control valve to the floor.

d. Other Areas not included in the Hydraulic calculations

There are a few areas on the ground floor not hydraulically calculated including the resident assistant apartments, office spaces, loading dock, and access corridor near the fire pump room. These systems in these areas were similar to more remote systems on the same feed mains, or size of the area using the room/corridor remote area and do not require the additional calculations. The loading dock area was small but did not require a dry system. Per Phoenix Fire Code 903.3.5.4, the main branch lines supplying any exterior sprinklers is required to be 2 inches minimum.

The trash chute will be protected in accordance with NFPA 13 section 22.15 requiring sprinklers in the chute at every other level, and at the top. The chute discharge is exterior and protected by a local system.

HYDRAULIC CALCULATIONS

Hydraulic calculations for the remote areas are provided in the Appendix I. Hydraulic calculations were calculated using the HASS software for each area. Some pipe lengths and sizes area assumed and are to be revised during the final detail sprinkler design.

The city water supply is strong and pressure has been historically steady in the range provided in the water flow test. Due to the building height and standpipe requirements, a fire pump will be required to boost pressure for the higher floors and hose stream requirements.

STANDPIPE SYSTEM

The standpipe system design and installation is based on the requirements of NFPA 14. As defined in NFPA 14:5.3.2, a Class I Standpipe system is appropriate given the hose requirements and the light hazard classification. The standpipe systems are provided in each stairwell of the towers for access by the fire department, with fire department connections at the ground level. A standpipe is provided in each stairwell with the eastern stairwells containing the combination wet riser and standpipe for the tower sprinkler systems. Hose connections are to be provided at every floor with two hose connections located on the roof. Due to the length of the residential towers, an additional hose station is required in each hall.

Two remotely located fire department connections are required for the high rise per NFPA 14:7.12.2. The sprinkler system shall be designed to accommodate outlet pressures and water flows in accordance with NFPA 14 and inlet pressures consistent with Phoenix Fire Equipment delivering 150 psi at 1500 gallons per minute. The standpipe is required to be hydraulically designed and provide 500 gallons per minute at 100psi the most remote hose connection (roof) plus an additional 250 gallons per minute for the second standpipe on the floor.

WATER SUPPLY AND FIRE PUMP

An electric horizontal split case fire pump is located on the ground floor near the rear services entrance and egress corridor. A typical arrangement is shown in Figure 14. The Pentair/Fairbanks pump supplies 1000 gallons per minute @ 100psi using a 1770RPM Electric Motor and a 5" 1824F Fire Pump. The pump supply is from the 16-inch city main and is fed thru a 6-inch pipe supplying the pump and a 6-inch bypass which supplies the building fire protection manifold.

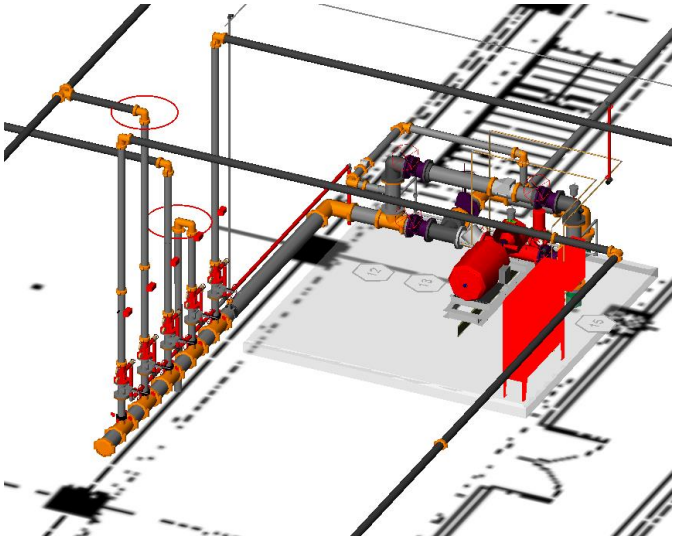


FIGURE 14. RENDER OF FIRE PUMP ROOM – TYPICAL ARRANGEMENT

The water supply provided by the fire pump and the city water supply is shown below in Figure 15. The city water pressure is adequate for most applications, and flow is available above that which is required. The height of the residential towers and use of standpipes does require additional pressure to raise the water to the top floors. The fire pump is sized to boost the city pressure but not to exceed 175psi. Additional safeguards against overpressure are provided in pressure reducing valves located on floor control valves.

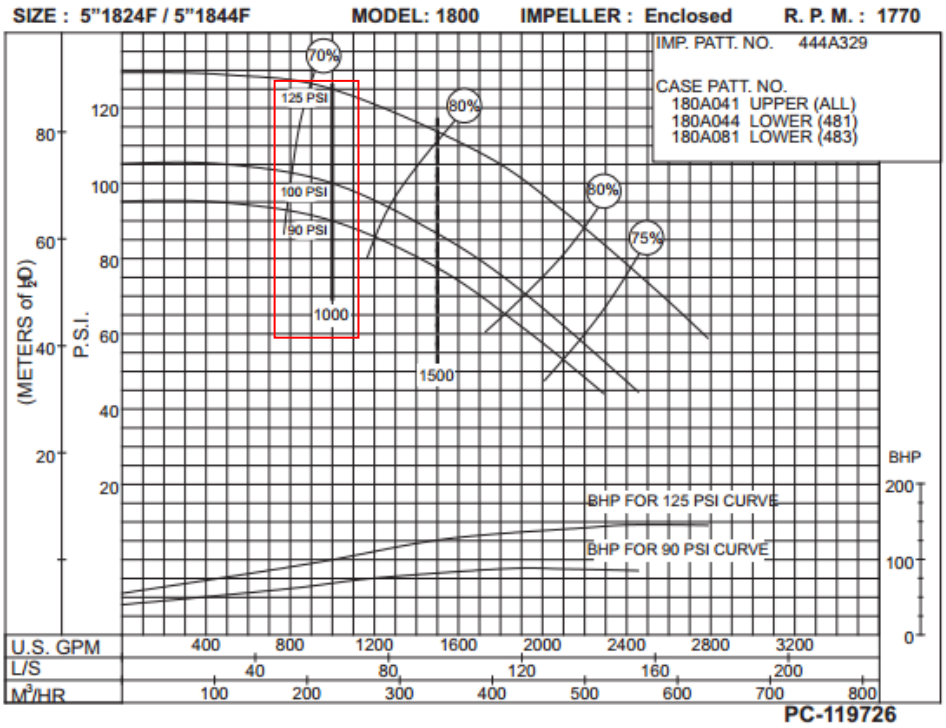


FIGURE 15. PUMP PERFORMANCE CURVE – 5" 1824F MODEL 1800

SPECIAL HAZARD SYSTEMS

At the time of this report no information was available on wet extinguishing system to protect cooking appliances or fryers in the Café and Cafeteria. This information is to be updated when available. The cooking hoods are designed and supplied as an assembly including the fire protection system designed according to UL 710 and UL 710B for recirculating systems. The hoods for the commercial cooking equipment in these areas are required to be non-combustible Type I by IMC section 507 for cooking processes that produce grease or smoke. The approved fire suppression system is required by IMC section 509 for a Type I hood.

A relay has been provided on the fire alarm performance drawings to monitor the system releasing panel.

FIRE ALARM SYSTEMS

GENERAL

The building is 100% sprinklered. The building is staffed at a security desk 24 hours a day to monitor student entry and building emergencies. It is a conventional system with a local Fire Alarm Control Panel (FACP) and remote Annunciator (FAAP). The type of alarm system as defined in NFPA 72, section 3.3.284.1 is a Central Station Service Alarm System with all signals transmitted to a supervised listed central station. A resource officer is onsite 24 hours a day and responds to alarms, supervisory, and trouble signals.
Characteristics are prescribed by International Fire Code (PFC) and NFPA 72 National Fire Alarm and Signaling Code. The system has Class B circuitry meeting the requirements of NFPA 72 section 12.3.2. The system is zoned as required by PFC 907.6.3.2 with alarm initiating devices separated by floor.

Emergency Voice/Alarm Communication Systems are required for the high rise. This consists of speaker strobes throughout the building, a paging control panel and fire fighter phone in the fire command center, as well as a local operator console (LOC) behind the security desk.

Per PFC 907.5.2.2, emergency voice/alarm communication systems (EVACS) is installed per NFPA 72 as required. PFC 907.2.13 for High Rise Buildings requires fire department communication systems and EVACS. The system shall be designed to evacuate the floor above and below the fire floor. At a minimum, speakers shall be provided in the following zones: elevators, exit stairways, each floor, and areas of refuge. The system shall also be able to broadcast live messages.

The Fire Alarm Control Panel (FACP) is located in the fire command center near the south entrance for fire department access and elevator control. An additional remote annunciator panel is located at the security desk with a pull station. The Remote Fire Alarm Annunciator Panel (FAAP) is located at the Security Desk.

The system as required by ASU consists of an EST3 Central processing unit, paging module, firefighter module, remote local operator console, dual loop SLC extender, modem communicator (DACT), and a Class B network communication card. The additional equipment provided consists of Intelligent Heat Detectors, Duct Detectors, Smoke Detectors, Speakers and Horn Strobes. Each floor has a dedicated power supply. Additional information on the components is available in the data sheets in the Appendix G.

INITIATING DEVICE LOCATIONS

This building is a high rise and is required by PFC 907.2.13 to have automatic smoke detection in areas without sprinkler protection, elevator lobbies, machine, rooms and shafts, duct detectors, and fire department communication systems at each floor within the stairwell.

University buildings (R-2) are required to have automatic smoke detection Per PFC 907.2.9.3, which activates the occupant notification system in common spaces, dwelling units, and interior corridors as well as service areas laundry, mechanical, and storage. PFC 907.2.11.2 requires R-2 occupancies have single or multi-station smoke alarms in sleeping areas, and outside of sleeping areas. In the event of activation of one smoke alarm, all alarms in the dwelling shall sound.

The ground floor and basement areas have additional requirements as assembly, office, mercantile, and industrial areas. On the ground floor per PFC 907.2.13.1.1, duct smoke detectors are used to initiate alarms in these areas. Residential areas on the ground floor has smoke detectors as prescribed in the dormitory towers. Other areas including mechanical equipment, electrical transformers, telephone equipment or similar rooms without sprinkler protection.

Elevator machine rooms, shafts, and elevator lobbies have smoke and heat detection as required by PFC and NFPA 72 section 21.3 and 21.4. Additional details are provided in the Section on elevators.

Any areas in the basement with fuel fired appliances or on the ground floor has a carbon monoxide detector per PFC 908.7. The tower sleeping areas do not have fuel burning appliances and do not require carbon monoxide detectors per exception 1 and 3 of this requirement.

Duct Smoke detectors are required per IMC, Section 606 to be installed in plenums with more than 5,000 cfm and serving not more than 10 air-inlets in R-1 and R-2 occupancies. In other occupancies plenums having capacity of more than 2000cfm shall have detectors installed in the main return and exhaust plenums.

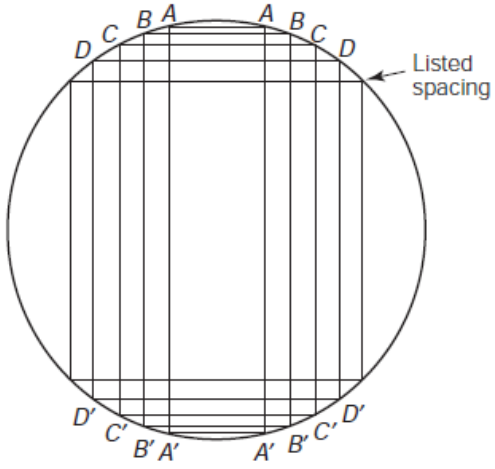
Water flow and valve tamper switches are installed on all system risers and standpipe risers. Additional water flow sensors are installed at each floor to alarm individual floors.

SPACING OF INITIATING DEVICES

Per NFPA 72 section 17.14, fire alarm pull stations are installed within 5 feet of each exit doorway and when the travel distance exceeds 200 foot.

Smoke detectors are installed on typical 30 feet listed spacing and at larger distances in corridors. In most dormitory rooms and service rooms spacing requirements will not be an issue due to their small size. All areas of the ceiling are within 21 feet of the detectors. Smoke detectors in the hallways are spaced at a maximum of 41 feet as allowed per Figures 16 and 17 showing NFPA 72 Figures A.17.6.3.1.1 (g) and A.17.6.3.1.1 (h).

Smoke detectors in dormitory rooms with kitchens shall not be installed within 10 feet of cooking surfaces per NFPA 72 section 29.8.3.4(4) unless specifically listed for the application.



Rectangles

A = 10 ft × 41 ft = 410 ft² (3.1 m × 12.5 m = 38 m²)
B = 15 ft × 39 ft = 585 ft² (4.6 m × 11.9 m = 54 m²)
C = 20 ft × 37 ft = 740 ft² (6.1 m × 11.3 m = 69 m²)
D = 25 ft × 34 ft = 850 ft² (7.6 m × 10.4 m = 79 m²)

Listed spacing for heat detectors only = 30 ft × 30 ft = 900 ft² (9.1 m × 9.1 m = 84 m²)

Note: Smoke detectors are not listed for spacing. Use manufacturer's coverage recommendations and this figure.

FIGURE A.17.6.3.1.1(g) Detector Spacing, Rectangular Areas.

FIGURE 16. DETECTOR SPACING IN RECTANGULAR AREAS FROM NFPA 72 FIGURE A.17.6.3.1.1 (g)

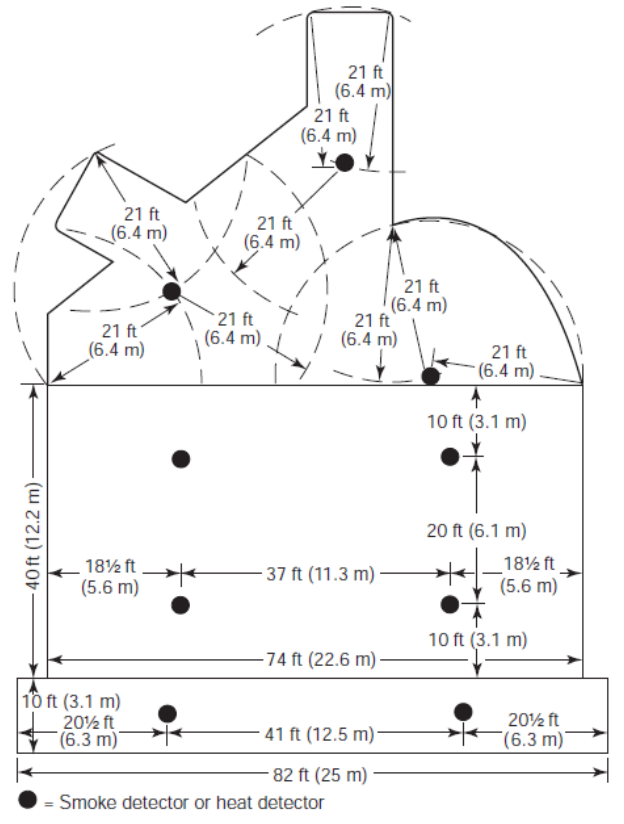


FIGURE A.17.6.3.1.1(h) Smoke or Heat Detector Spacing Layout in Irregular Areas.

FIGURE 17. SMOKE OR HEAT DETECTOR SPACING IN IRREGULAR AREAS FROM NFPA 72 FIGURE A.17.6.3.1.1 (h).

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NOTIFICATION APPLIANCES

Strobe candela rating is required to e indicated on the drawings next to the device. Outdoor devices have a “WP” shown on the drawings indicating weather protected. Speaker strobes are to be installed per NFPA 72 requirements and the manufacturers recommended approaches.

Strobe spacing is based on the size of the room and the candela required per NFPA 72 section 18.5.5.4 and the listed Tables. Figure 18 is a good visual representation of wall mounted device spacing. A majority of the devices are to be wall mounted with a few ceiling mounted devices in the ADA compliant rooms. ADA compliant bathrooms are provided with a 15 Cd strobe and the dwelling areas are provided with a 75 Cd strobe.

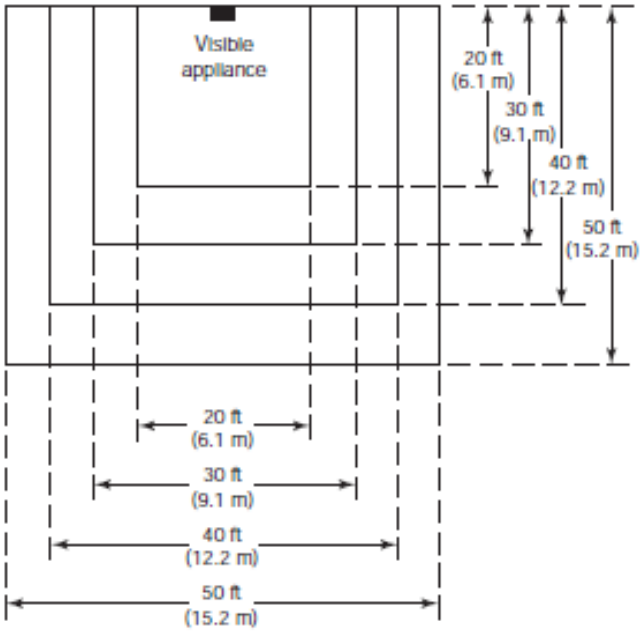

FIGURE 18.5.5.4.1 *Room Spacing for Wall-Mounted Visible Appliances.*

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FIGURE 18. ROOM SPACING FOR WALL-MOUNTED VISIBLE APPLIANCES

Tables 14 and 15 provide device locations and spacing on walls and ceilings in a descriptive form.

TABLE 14. ROOM SPACING FOR WALL-MOUNTED VISIBLE APPLIANCES

Maximum Room Size		*Minimum Required Light Output [Effective Intensity (cd)]*	
ft	*m*	*One Light per Room*	*Four Lights per Room (One Light per Wall)*
20 × 20	6.10 × 6.10	15	NA
28 × 28	8.53 × 8.53	30	NA
30 × 30	9.14 × 9.14	34	NA
40 × 40	12.2 × 12.2	60	15
45 × 45	13.7 × 13.7	75	19
50 × 50	15.2 × 15.2	94	30
54 × 54	16.5 × 16.5	110	30
55 × 55	16.8 × 16.8	115	30
60 × 60	18.3 × 18.3	135	30
63 × 63	19.2 × 19.2	150	37
68 × 68	20.7 × 20.7	177	43
70 × 70	21.3 × 21.3	184	60
80 × 80	24.4 × 24.4	240	60
90 × 90	27.4 × 27.4	304	95
100 × 100	30.5 × 30.5	375	95
110 × 110	33.5 × 33.5	455	135
120 × 120	36.6 × 36.6	540	135
130 × 130	39.6 × 39.6	635	185

NA: Not allowable.

TABLE 15. ROOM SPACING FOR CEILING-MOUNTED VISIBLE APPLIANCES

Maximum Room Size		*Maximum Lens Height**		*Minimum Required Light Output (Effective Intensity); One Light (cd)*
ft	*m*	*ft*	*m*	
20 × 20	6.1 × 6.1	10	3.0	15
30 × 30	9.1 × 9.1	10	3.0	30
40 × 40	12.2 × 12.2	10	3.0	60
44 × 44	13.4 × 13.4	10	3.0	75
20 × 20	6.1 × 6.1	20	6.1	30
30 × 30	9.1 × 9.1	20	6.1	45
44 × 44	13.4 × 13.4	20	6.1	75
46 × 46	14.0 × 14.0	20	6.1	80
20 × 20	6.1 × 6.1	30	9.1	55
30 × 30	9.1 × 9.1	30	9.1	75
50 × 50	15.2 × 15.2	30	9.1	95
53 × 53	16.2 × 16.2	30	9.1	110
55 × 55	16.8 × 16.8	30	9.1	115
59 × 59	18.0 × 18.0	30	9.1	135
63 × 63	19.2 × 19.2	30	9.1	150
68 × 68	20.7 × 20.7	30	9.1	177
70 × 70	21.3 × 21.3	30	9.1	185

*This does not preclude mounting lens at lower heights.

Per manufacturer's specifications, corridor spacing of visual devices can be any length in a corridor less than 20 feet wide with a maximum spacing of 100 feet max, 15 feet from end of corridor, and a candela of 15cd. Figure 18.5.5.4.1 is a good visual guide to the placement of visual appliances.

The mounting of the devices follows NFPA 72 section 18.5.5 Appliance Location as stated below:

> **18.5.5.1*** Wall-mounted appliances shall be mounted such that the entire lens is not less than 80 in. (2.03 m) and not greater than 96 in. (2.44 m) above the finished floor or at the mounting height specified using the performance-based alternative of 18.5.5.6.

As required by NFPA 72, Table A.18.4.3 provides the *Average Ambient Sound Level According to Location* (dBA) for a Residential Occupancy is 30dB Mercantile Occupancy is 40dB, and Mechanical Rooms are 85dB.

TABLE 16. AVERAGE AMBIENT SOUND LEVEL ACCORDING TO LOCATION – TABLE A.18.4.3 FROM NFPA 72

Location	*Average Ambient Sound Level (dBA)*
Business occupancies	55
Educational occupancies	45
Industrial occupancies	80
Institutional occupancies	50
Mercantile occupancies	40
Mechanical rooms	85
Piers and water-surrounded structures	40
Places of assembly	55
Residential occupancies	35
Storage occupancies	30
Thoroughfares, high-density urban	70
Thoroughfares, medium-density urban	55
Thoroughfares, rural and suburban	40
Tower occupancies	35
Underground structures and windowless buildings	40
Vehicles and vessels	50

The minimum sound level for horns allowed by NFPA 72 18.4.3.1 is the average ambient plus 15dB. For the two styles audible appliances (high and low dB), the 6 dB rule is to be used to assign the appropriate power levels for the device.

The 6 decibel rule states that if you double the distance from the source you reduce the sound level by 6 decibels. This is illustrated in the Table above.

TABLE 17. DECIBEL REDUCTION BASED ON THE 6 DECIBEL RULE

Distance	High dB	Low dB	Candela
10 feet	84.4	79.4	15
20 feet	78.4	73.4	15
30 feet	75.4	70.4	30 (28')
40 feet	72.4	67.4	75

A critical aspect of an emergency voice/alarm communication system (EVACS) is the ability to understand the message and respond. A temporal pattern is easily comprehended even if the message does not come through clear. In the event serious damage or an unknown danger in the building, clearly communicating the message to shelter in place vs. get out is important.

Background noise can have a significant impact on the emergency message. The location of HVAC vents, fans, and compressors can provide a constant low level noise. Additional sources of background noise can be traffic, truck deliveries, and airplanes (commercial and military). A 10dB boost to the voice signal can overcome some background noise. A frequency analysis can be performed in areas with consistent noise like factory floors.

Reverberation can occur when the message is reflected back at the listener muddling the original message almost like listening to two conversations. The construction materials and wall arrangements affect how the sound is absorbed versus being returned to the source. Carpeted floors and softer materials absorb the stray frequencies, where concrete and steel scattered the message in multiple directions. This is a difficult factor to address and may require professional analysis and specific speaker locations.

Distortion in the original message can occur when the voice message is sent to the speaker with too much power. The speaker is overdriven and the message is not produced clearly. It may still be under stood, but it may take longer to comprehend.

The NEMA SB 50 *Emergency Communications Audio Intelligibility Applications Guide* is a good source of information on the topic of intelligibility.

The only reason to give priority over the fire alarm is because the situation would result in greater risk to the occupants like domestic terrorism with individuals targeting businesses and coworkers. Pulling a fire alarm pull station to evacuate the building into a potential armed assailant or an area with an explosive device could be one method to use the evacuation system against the occupants.

NFPA 72 24.4.3.1.7 allows the level of the recorded messages to be determined by the emergency response plan (ERP), and 24.4.3.1.8 specifically allows the ERP to higher priority than fire alarm activation. NFPA 24.4.3.2.9 requires a manual means to relinquish control of the fire alarm system at each mass notification location. A copy of the Fire Safety Management Plan in accordance with PFC, Chapter 4 is provided in the Appendix M.

Terrorism related events is a required section of emergency plans. Other situations could be a local chemical release producing hazardous conditions and simultaneously there is a fire in the facility. The potential risks must be weighed and a response planned anticipating such events on a general scale.

ALARM AND TROUBLE SIGNALS

Water flow devices are provided at the lateral connection to each riser on each floor for each zone. Electrical supervision is provided on all sprinkler control valves with tamper switches. On site and Central Station Monitoring is provided for all alarm and trouble signals.

FIRE PUMP

The fire pump is located on the ground floor in a mechanical room. Signals are provided for supervisory, trouble, and pump running notification. The fire pump is an electric fire pump, and provides with emergency power from the emergency generator to ensure operation in the event of a power failure.

KITCHEN HOOD EXTINGUISHING SYSTEM

All Type I hoods are protected by wet chemical extinguishing systems with high temperature heads and manual pull stations per NFPA 17. These systems are required to be connected to the fire alarm system to initiate an alarm if activated.

HEAT DETECTION

Heat Detectors are provided in the elevator shafts per NFPA 72 section 21.3 and 21.4. Activation of the heat detectors shunt the elevator power.

CARBON MONOXIDE DETECTION

Carbon monoxide detection is provided in areas where fuel burning equipment is located per PFC 908.8.1. The system are installed per NFPA 720. In the event of a high CO concentration a local alarm sounds and a supervisory alarm sounds at an occupied location.

REFRIGERANT DETECTION SYSTEMS

Machinery rooms with refrigeration equipment that could cause a hazardous condition if a refrigerant leak were to occur as required to have a refrigerant leak detector actuated at a value corresponding to the TLV-TWA values in the IMC. Most refrigerants are odorless and colorless making them hard to detect. If a large leak occurs victims are typically incapacitated with their rescuers. The detectors are required by PFC 606.8 to have audible and visual alarms. Detectors and alarms are required to be placed in approved locations in accordance with NFPA 72 and PFC Section 907.5.2 and 907.5.2.3. Alarms are required inside and outside of the space and detection sample lines are required to be located at floor level and potential leak points.

ELEVATOR SYSTEMS

Elevators will be provided with smoke detection on each level within 21 feet of the elevator door per NFPA 21.3.5 to initiate Phase I recall. Additional smoke and heat detectors are in provided in the elevator machinery rooms as required.

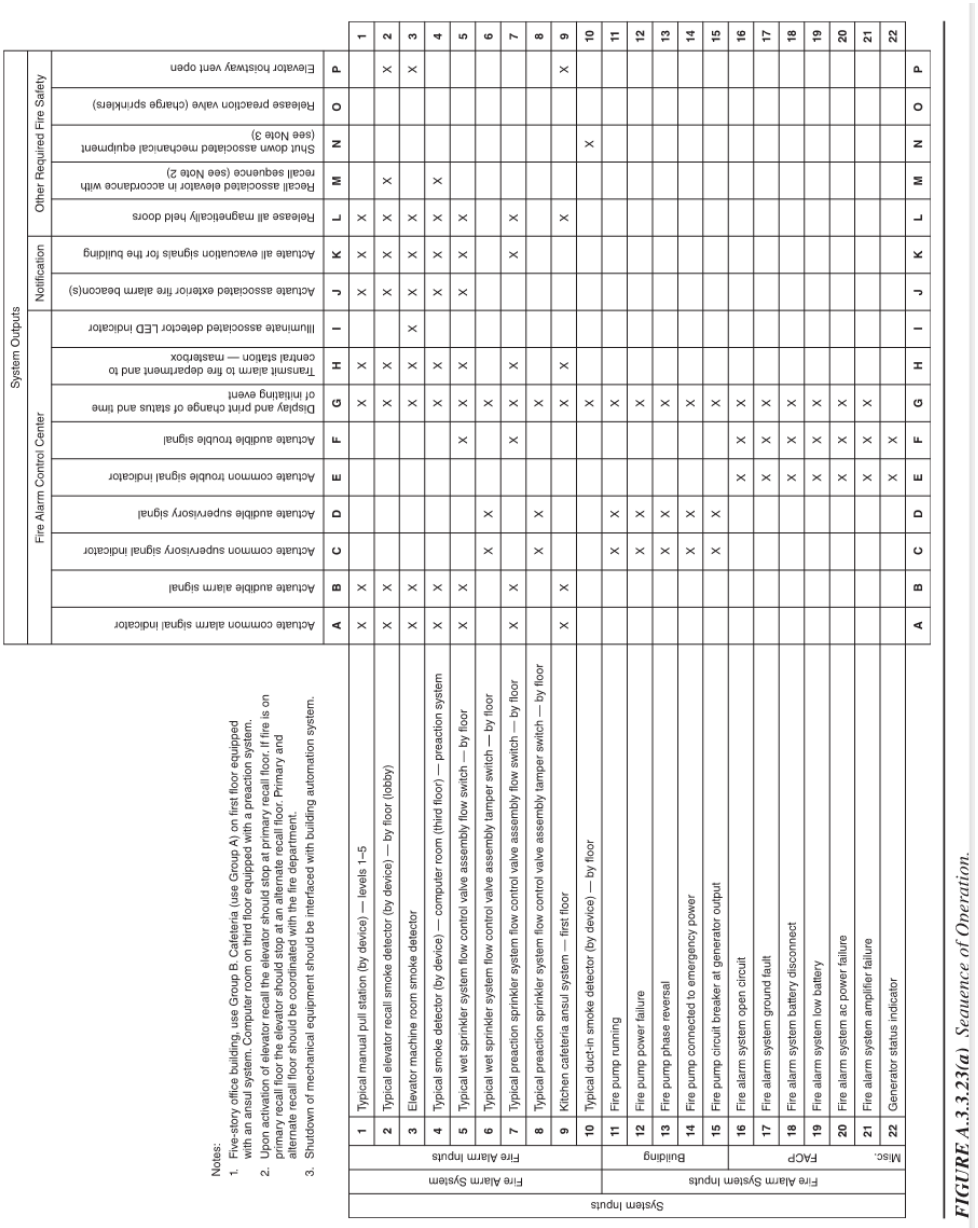
A detailed description of Elevator function is discussed in the Elevator section.

ECONDARY POWER SUPPLIES

i. Secondary power supply calculations follow the requirements of NFPA 72 section 10.6.7.2.1.
ii. Battery calculations shall include 20 percent safety margin.
iii. The secondary power supply for in-building emergency voice and mass notification systems shall operate in standby for 24 hours and in alarm for 15 minutes.
iv. Speakers for the voice evacuation system are powered from the main VECP on the main floor. Strobes are powered by a separate remote power booster supply.
v. Sounder bases with a 520 Hz audible signal for the dwelling room smoke alarms are powered by a separate remote power booster supply.
vi. Strobes in the hallways and restrooms are powered by a separate remote power booster supply.

FIRE ALARM MATRIX

The specific operation sequence of the fire protection systems should follow the example in Figure 19 from NFPA 4 *Standard for Integrated Fire Protection and Life Safety System Testing* which provides a detailed example of a fire alarm sequence of operations.



Notes:
1. Five-story office building, use Group B. Cafeteria (use Group A) on first floor equipped with an ansul system. Computer room on third floor equipped with a preaction system.
2. Upon activation of elevator recall the elevator should stop at primary recall floor. If fire is on primary recall floor the elevator should stop at an alternate recall floor. Primary and alternate recall floor should be coordinated with the fire department.
3. Shutdown of mechanical equipment should be interfaced with building automation system.

System Inputs				System Outputs																					
				Fire Alarm Control Center										Notification		Other Required Fire Safety									
				Actuate common alarm signal indicator	Actuate audible alarm signal	Actuate common supervisory signal indicator	Actuate audible supervisory signal	Actuate common trouble signal indicator	Actuate audible trouble signal	Display and print change of status and time of initiating event	Transmit alarm to fire department and to central station — masterbox	Illuminate associated detector LED indicator	Actuate associated exterior fire alarm beacon(s)	Actuate all evacuation signals for the building	Release all magnetically held doors	Recall associated elevator in accordance with recall sequence (see Note 2)	Shut down associated mechanical equipment (see Note 3)	Release preaction valve (charge sprinklers)	Elevator hoistway vent open	
				A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P						
Fire Alarm System	Fire Alarm Inputs	1	Typical manual pull station (by device) — levels 1–5	X	X					X	X		X	X	X					1					
		2	Typical elevator recall smoke detector (by device) — by floor (lobby)	X	X					X	X		X	X	X	X			X	2					
		3	Elevator machine room smoke detector	X	X					X	X	X	X	X	X				X	3					
		4	Typical smoke detector (by device) — computer room (third floor) — preaction system	X	X					X	X		X	X	X					4					
		5	Typical wet sprinkler system flow control valve assembly flow switch — by floor	X	X				X	X	X		X	X	X					5					
		6	Typical wet sprinkler system flow control valve assembly tamper switch — by floor			X	X			X										6					
		7	Typical preaction sprinkler system flow control valve assembly flow switch — by floor	X	X				X	X	X			X	X					7					
		8	Typical preaction sprinkler system flow control valve assembly tamper switch — by floor			X	X			X										8					
		9	Kitchen cafeteria ansul system — first floor	X	X					X	X				X				X	9					
		10	Typical duct-in smoke detector (by device) — by floor							X							X			10					
Building		11	Fire pump running			X	X			X										11					
		12	Fire pump power failure			X	X			X										12					
		13	Fire pump phase reversal			X	X			X										13					
		14	Fire pump connected to emergency power			X	X			X										14					
		15	Fire pump circuit breaker at generator output			X	X			X										15					
Fire Alarm System Inputs	FACP	16	Fire alarm system open circuit					X	X	X										16					
		17	Fire alarm system ground fault					X	X	X										17					
		18	Fire alarm system battery disconnect					X	X	X										18					
		19	Fire alarm system low battery					X	X	X										19					
		20	Fire alarm system ac power failure					X	X	X										20					
		21	Fire alarm system amplifier failure					X	X	X										21					
Misc.		22	Generator status indicator					X	X											22					
				A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P						

FIGURE A.3.3.23(a) Sequence of Operation.

FIGURE 19. SEQUENCE OF OPERATIONS FROM NFPA 3 FIGURE A.3.3.23(a)

PATHWAY SURVIVABILITY

Per NFPA 72 section 24.3, the method of evacuation is floor evacuation and requires a Level 0-3 pathway survivability. A risk analysis is required to be performed to determine the necessary level of survivability. A dedicated amp is provided for each floor and not shared between floors.

ACCESS CONTROL

The residential dormitory towers are accessible through the security station located in the south tower. All student residents have identification cards that are scanned when entering the elevator lobby. The North and South Towers primary access point is the four elevators. Students in the north tower must take the elevator to the desired floor and then cross the open air bridge to the other side. The egress stairways are not accessible from the ground level and are locked to prevent entry from the stairways.

EMERGENCY COMMUNICATION SYSTEMS (ECS)

This section describes all emergency communication systems including for fire alarm indicating appliances and how they are coordinated with other active fire protection systems throughout the facility.

In building communication is provided as specified in NFPA 72 section 24 and 25. Two way telephone communication systems are provided at each floor in the stairwell, each notification zone, each elevator cab, elevator lobbies, machine rooms, emergency power rooms, fire pump rooms, areas of refuge, and as required by the authority having jurisdiction.

Emergency responder radio coverage is required per PFC section 510. This system provides complete radio coverage in all areas of the building. Battery backup systems and signal booster are required to ensure operation during building emergencies. Secondary power is required to support the system for a minimum of 24 hours. System acceptance is based on a performance test of the system by dividing each floor of the building into 20 grids per PFC 510.5.3.

COMMERCIAL COOKING SYSTEMS

COMMERCIAL HOOD TYPE AND CLASSIFICATION

Commercial cooking occurs in several suites in the building. There is an interior cafeteria and two cafés located on the ground floor. A non-combustible Type I hood is required at or above all commercial cooking appliances that produce grease vapors in accordance with PFC 609 and 610. The ventilation system is operated at the required rate to remove the grease vapors. All

construction within 16 inches of the hood is non-combustible.

COMMERCIAL HOOD WET CHEMICAL FIRE EXTINGUISHING SYSTEMS

An automatic fire-extinguishing system is required for all commercial cooking appliances where grease vapors exist or cooking oils are used. The automatic fire extinguishing systems are required to be a type and arrangement suited to the hazard. Pre-engineered automatic dry- and wet-chemical extinguishing systems required to be tested in accordance with UL 300 and, listed and labeled for the intended application. The systems are to be installed and maintained according to NFPA 17, Dry-chemical extinguishing systems, and NFPA 17A, Wet-chemical extinguishing systems. Recommendations on ITM are included in the Appendix J.

EMERGENCY AND STANDBY POWER SYSTEMS

This section describes the fire protection aspects of the secondary and emergency power supply as required by PFC 403.4. The diesel generator is located on the exterior of the building on the north east side. The 180kW generator is provided with a 416-gallon diesel tank and installed on slab. At 100% of rated load it provides standby power for approx. 30 hours. The diesel is stored under the generator in a tank with safety features shown in Figure 20 meeting the requirements of NFPA 30 Flammable and Combustible Liquid code per PFC 5704.2.7. It is located a minimum of 10 feet from the property line and 5 feet from important buildings and per PFC Chapter 57 and NFPA 30, Table 15.3 requirements. No smoking is permitted within 50 feet of the generator.

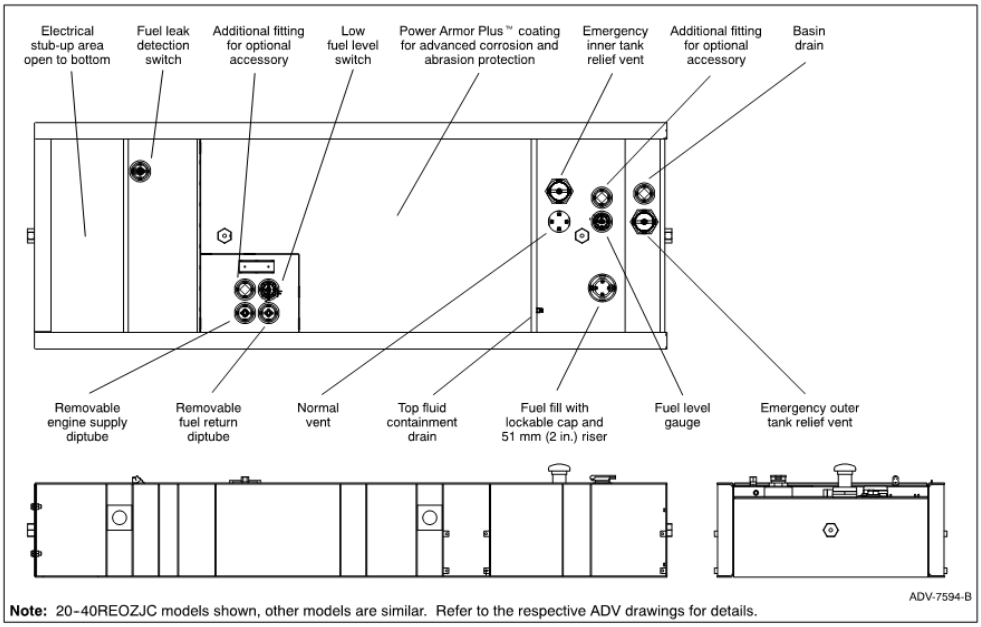


FIGURE 20. GENERATOR FUEL TANK DETAILS

The generator is required to be protected from tampering or trespassers by PFC 5704.4.2.3. The current level of protection consisting of fencing is not adequate because it allows access to one side of the equipment.

As required by PFC 403.4.8.2, a standby power system complying with Chapter 27 and Section 3003 shall be provided for standby power loads. Where elevators are provided in a *high-rise building* for *accessible means of egress*, fire service access or occupant self-evacuation, the standby power system shall also comply with Sections 1007.4, 3007 or 3008, as applicable.

The standby power systems support the following loads:

- Power and lighting for the fire command center
- Ventilation and automatic fire detection for smoke proof enclosures
- Elevators

As required by PFC 403.4.9.1, an emergency power system complying with Chapter 27 supplies the power for the following systems:

Transfer time after power failure is 10 seconds for:
- Exit signs and exit illumination (PFC Chapter 10)
- Elevator car lighting
- Fire alarm systems
- Fire detection systems
- Sprinkler alarm systems
- Emergency voice/alarm systems

Transfer time after power failure is 60 seconds to full power for:
- Electrically powered fire pumps
- Fire pump control and status panels
- Smoke management systems, panels, and controls
- Elevators
- Lighting for elevator lobbies, fire command center, generator room, and fire pump room

INSPECTION, TESTING, AND MAINTENANCE (ITM)

Emergency power systems are required to be inspected and tested in accordance with NFPA 110 and NFPA 111.

EXPLOSION PREVENTION AND CONTROL SYSTEMS

There are no hazardous processes, materials, or hazards that require explosion prevention and control systems.

INSPECTION, TESTING, AND MAINTENANCE

Inspection, Testing and Maintenance (ITM) criteria is in the process of being developed as equipment is specified. A complete program is not expected at this time. The final fire protection design is deferred and testing criteria is developed based on NFPA 25, NFPA 72, NEC (NFPA 70), and NFPA 92 (2012). Examples of ITM criteria are provided in the Appendix J.

These standards provide a minimum for inspection, testing, and maintenance. Inspection frequency can vary based on the occupancy classification and hazards protected. High risk processes may require additional attention above the minimum recommended practices.

NFPA 25 - INSPECTION TESTING AND MAINTENANCE OF WATER BASED FIRE PROTECTION SYSTEMS

NFPA 25 *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* is the basis for all maintenance programs for ITM of the sprinkler system.

A Fire pump boosts the city water pressure for the building fire protection systems and are critical piece of fire protection equipment. The fire pump is required to be started each week and inspected for maintenance issues or system problems. The pump should be started automatically by dropping the water pressure in the pressure sensing line. This ensures the pump is operational if an event occurs. During the fire pump annual flow test, confirm its performance at churn, 100%, and 150% flow. This helps identify any system issues with low pressure or pump damage before the issues are discovered during an event.

Visual and physical inspection of indicating control valves is a critical part of any ITM program. The closure of any system valve even partially can impair the sprinkler system and result in a large loss of life or property. Any control valve impairments need to be reported to the fire marshal.

i. Testing and maintenance frequencies should be set using prescriptive and performance based methods, or setting the interval so that missing an inspection or test does not create a hazardous situation.

ii. A summary of the Sprinkler System Inspection, Testing and Maintenance (ITM) from NFPA 25 requirements are provided in the Appendix J.

iii. NFPA 25 Table 5.1.1.2 *Summary of Sprinkler System Inspection, Testing, and Maintenance* provides ITM frequencies for most sprinkler components such as gauges, control valves, alarm devices, supervisory devices, and sprinklers.

iv. NFPA 25 Table 5.1.1.2 *Summary of* Standpipes and Hose *Inspection, Testing, and Maintenance* provides the ITM frequencies for standpipes and hoses.

v. NFPA 25 Table 5.1.1.2 *Summary of* Fire Pump *Inspection, Testing, and Maintenance* Inspection, Testing, and Maintenance provides the ITM frequencies for fire pumps.

NFPA 72 - NATIONAL FIRE ALARM CODE

NFPA 72 National Fire Alarm Code is the basis for all maintenance programs for ITM of the fire alarm system.

The functions of the alarm system must be tested on a regular basis to ensure they perform when needed. Testing and maintenance frequencies should be set using performance based testing, or setting the interval so that missing an inspection or test does not create a hazardous situation.

Impairments and deficiencies must be fixed and promptly. If not corrected the owner must be notified within 24 hours.

NFPA 70 - NATIONAL ELECTRIC CODE

NFPA 70 National Electric Code is the basis for all maintenance programs for ITM of the sprinkler system.

EQUIPMENT AND TOOLS

Any specialized tools for maintaining and testing fire protection, fire alarm, smoke detection, or other fire protection equipment should be maintained on site.

CONCLUSION (FIRE PROTECTION AND LIFE SAFETY SYSTEMS)

Based on a prescriptive evaluation of the building, it is in compliance with the applicable codes as defined in this document.

The fire protection systems and water supplies are designed per PFC and NFPA 13 requirements with a fire pump provided to boost city water pressure to accommodate the 13th floor fire protection systems and standpipe requirements at the most remote location.

The fire alarm systems have been designed in accordance with PFC and NFPA 72 requirements for a high rise occupancy. Additional hazards have been identified and protection systems such as carbon monoxide detection, refrigerant detection, carbon dioxide protection, and commercial cooking equipment suppression systems have been engineered into the building design.

11. MEANS OF EGRESS SYSTEMS AND COMPONENTS

INTRODUCTION

This section describes a general approach to the design of the egress systems. Life Safety drawings showing egress components and routes are submitted to the Building Department for review and approval of the specific design. The means of egress were designed to meet the meet the requirements of PBC Chapter 10 and NFPA 101. The PBC is the city code and references NFPA 101. There is overlap between the documents, but the City has adopted the International Codes, so NFPA 101 is used for issues not addressed in the PBC and to provides alternative methods.

Specifically identified chapters of PBC used for means of egress are:
Chapter 10 Means of Egress

Specifically identified chapters of NFPA 101 used for means of egress are:
Chapter 7 Means of Egress
Chapter 8 Features of Fire Protection
Chapter 12 New Assembly Occupancies
Chapter 28 New Hotels and Dormitories
Chapter 36 New Mercantile Occupancies
Chapter 38 New Business Occupancies

A means of egress system consists of the exit access that leads to the exit. The exit is the portion of the building that provides a protected path to the exit discharge. The exit discharges into a public way or safe area. The means of egress is the way to, thru, and away from the emergency. The roof is a non-occupied space.

OCCUPANT LOAD CALCULATION SUMMARY

Occupant loads were calculated by using PBC Chapter 3, Chapter 10, and NFPA 101 and summarized in Table 18. These occupant loads were used to determine if the current design meets code and egress is adequate.

TABLE 18. OCCUPANCY LOAD CALCULATIONS BY FLOOR

FLOOR	GROUP	AREA (square feet)	OCCUPANCY LOAD FACTOR	OCCUPANT LOAD
BASEMENT	S-2	6,700	300 gross[1]	23
FIRST	A-2	5,369	15 net	358
	A-2	510	5 net	102
	A-2	2,200	200 gross	11
	B	6,100	100 gross	35
	M	5,610	30 gross	136
	R-2	2,150	200 gross	11
	S-2	2,110	300 gross	7
TWO TO THIRTEEN	R-2	South Tower - 9,250 North Tower - 9,720	200 gross	194 182
	S-2	South Tower - 580 North Tower – 630	300 gross	2 2
	A-3	Upper Lvl – 330 Lower Lvl – 430	15 net	22 29

EGRESS CAPACITY AND QUANTITY OF EXITS BY FLOOR

Basement egress is adequate given the low occupancy of the basement. Figure 21 shows exit corridors and the number of exits is adequate from the basement. There are two exits provided which meets the occupancy requirements of NFPA 101 – 7.4.1.1 and PBC Table 1015.1. However, PBC 1015.3 requires a minimum of two exits from water heater and furnace rooms over 500 square foot. These rooms have not been identified.

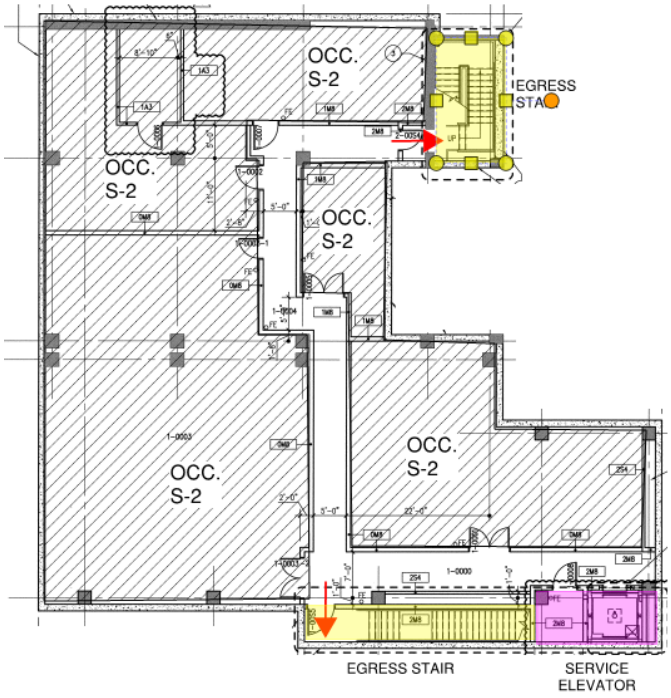


FIGURE 21. BASEMENT OCCUPANCY AND EXITS

Main Ground Floor Assembly Area egress is adequate and can include egress flow from additional occupancies as seen in Figure 22. The total egress capacity from the central assembly are is accomplished through seven double door exits without interfering with the egress from the stairways. Available egress from this area is 2,265 occupants which accommodates all ground floor occupancies and additional side loads from offices, shops, and restaurants.

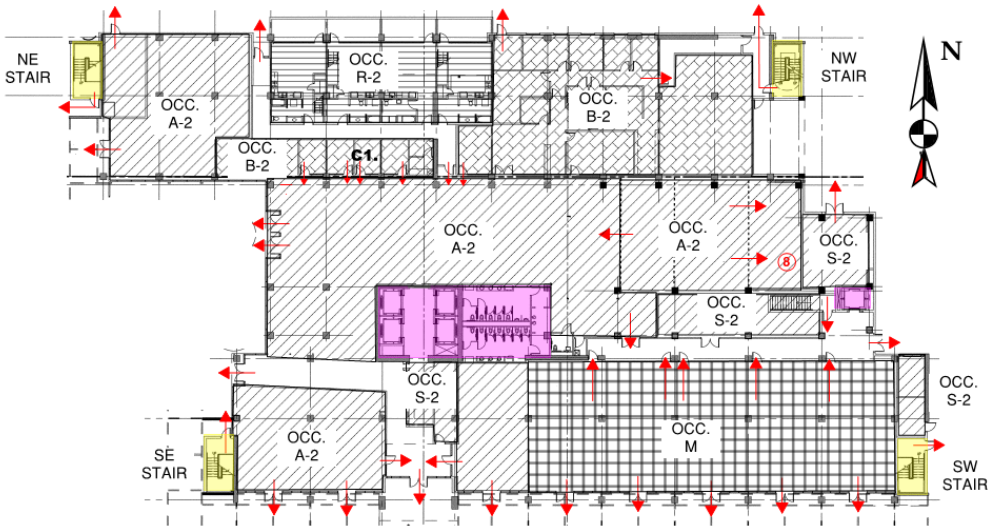


FIGURE 22. GROUND FLOOR OCCUPANCIES AND EXITS

Exits for the main assembly area are evenly dispersed on the east, west, and south walls. The main entrance is to the south, three exits are provided on the west, two on the north, and one on the west. Per NFPA 101, an area with an occupant load exceeding 1,000 shall have not less than 4 exits. There are seven exits and they meet the requirements of 12.2.3.6.6 and meet the requirements for remoteness in NFPA 101 – 7.5.1.3.

South Tower egress is adequate per the PBC requirements and NFPA requirements for floors 2 through 13. **North Tower egress is adequate** per the PBC requirements and NFPA requirements for floors 2 through 13. Areas of refuge are provided in the West stairwells per PBC 1007.6 and exterior areas for assisted rescue are provided in the East stairwells per PBC 1007.7. These areas are identified with the ADA rooms in Figure 23.

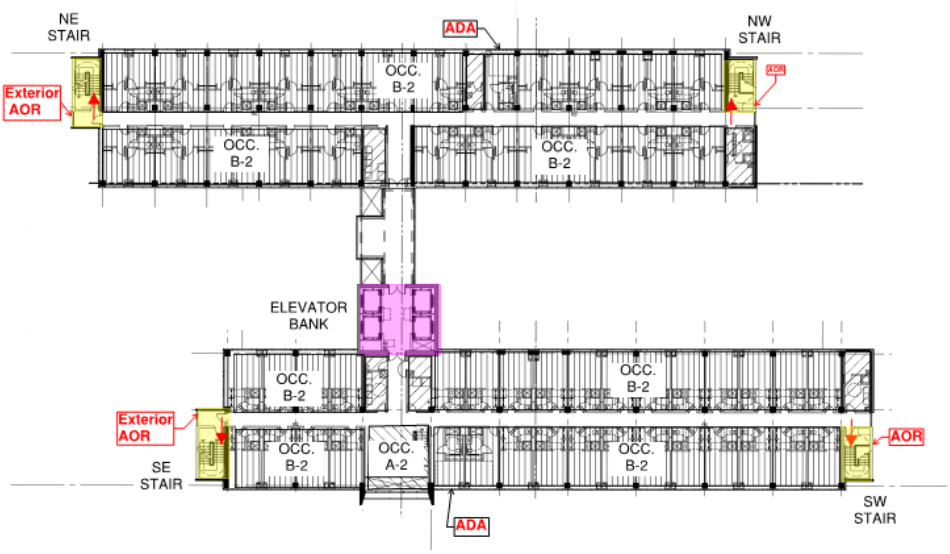


FIGURE 23. NORTH AND SOUTH TOWER OCCUPANCIES AND EXITS

South Tower and North Tower occupancies are not combined because the bridge connecting the towers is not a horizontal exit. It is just a pedestrian and convenience bridge connecting each floor of the two towers. There is the potential for exposure from smoke or heat from a fire that consumes the assembly area on the ground floor on the bridge. There is potential loss of the bridge due to its exposure, a fire on the bridge seating, and issues with travel distance and shared occupant loads.

EXIT ARRANGEMENTS

There are no **horizontal exits** located in the building. The bridge between towers could be a converted to a horizontal exit, but per the plan both the double doors swing in the same direction. Given the proximity of the wheelchair accessible suites to the elevators, the option to have an exit and egress thru the elevators is beneficial in the north tower.

The **Ground floor assembly** (Figure 21) areas on the ground floor is designed as a gathering space for students for study and meals. This is a large open space with high ceilings and six double door exits around the perimeter of the building. Seating is not fixed and there is the potential for presentations, large meetings, or stage shows.

The **Residential Assistants**, and offices on the ground floor can exit thru the larger assembly areas. The ground floor shops and offices on the south side of the building discharge to the street, but have additional exits in the rear that discharge into a corridor.

The exit arrangements for the **Towers** are remote separated by 235 feet and placed at opposite ends of each tower as shown in Figure 23.

Figures 24 and 25 show the common paths of travel, egress paths, and dead ends per PBC Chapter 10 for the ground and tower floor plan. The building is protected by an automatic sprinkler system.

STAIR ACCESS

Enclosed stairs discharge to the exterior of the building from floors 2 thru 13 or into a 2-hour rated exit passageway leading to the exterior. The north east stair is the only stair that discharges into an interior corridor. Per NFPA 101:30.2.2.1.2 and PBC 1007.6, areas of refuge are provided in one stairwell in each tower on the east side of the building. These areas of refuge were provided based on the 2009 PBC, but are now excepted due to the sprinkler system.

Two additional exterior areas for assisted rescue are provided per PBC 1007.7 on the west side of the building. The areas are protected by a fire resistance rating of not less than 1 hour between the outside building wall and the edge of the platform. The exterior area for assisted rescue is 50% open to outside air as required by PBC 1007.8.1.

The west exit stairs are constructed as smoke proof enclosures with exterior landings, and the east stairs are pressurized. This is discussed in more detail in a later section on Smoke Control and Management Systems.

Convenience stairs which allow public circulation between the dormitory floors are not enclosed and not part of the egress system.

DOORS

Exit doors (including roof level stair entrances) are operable from the discharge side without the use of a key or special knowledge or effort. Exit doors swing in the direction of exit travel when serving an occupancy load of 50 or more. Panic hardware is installed on all exit doors provided with latches which serve Group A occupancies of 50 or more people. Rolling and horizontal sliding fire doors are not to be used for exiting.

COMMON PATH, TRAVEL DISTANCE, AND DEAD ENDS

A common path is the portion of the egress path traveled from the origin to a point where there are two separate and distinct choices of egress paths to two exits from the building are available. Travel distance is the entire length of the egress path from the origin to the exit. A dead end is the portion of the egress path that is only one way. All buildings are required to meet these distances as provided in Table 19 and 20. This section discusses the details associated with these components.

TABLE 19. REQUIRED COMMON PATH OF EGRESS TRAVEL – PBC TABLE 1014.3

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)		WITH SPRINKLER SYSTEM (feet)
	Occupant Load		
	≤ 30	> 30	
B, S[d]	100	75	100[a]
U	100	75	75[a]
F	75	75	100[a]
H-1, H-2, H-3	Not Permitted	Not Permitted	25[a]
R-2	75	75	125[b]
R-3[e]	75	75	125[b]
I-3	100	100	100[a]
All others[c, f]	75	75	75[a]

For SI: 1 foot = 304.8 mm.
a. Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
b. Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where *automatic sprinkler systems* are permitted in accordance with Section 903.3.1.2.
c. For a room or space used for assembly purposes having *fixed seating*, see Section 1028.8.
d. The length of a *common path of egress travel* in a Group S-2 *open parking garage* shall not be more than 100 feet (30 480 mm).
e. The length of a *common path of egress travel* in a Group R-3 occupancy located in a mixed occupancy building.
f. For the distance limitations in Group I-2, see Section 407.4.

Table 20 lists the maximum travel distance allowed by PBC Table 1014.3 based on the whether the building is protected by an automatic sprinkler system.

TABLE 20. EXIT ACCESS TRAVEL DISTANCE– PBC TABLE 1014.3

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, M, R, S-1	200	250[b]
I-1	Not Permitted	250[c]
B	200	300[c]
F-2, S-2, U	300	400[c]
H-1	Not Permitted	75[c]
H-2	Not Permitted	100[c]
H-3	Not Permitted	150[c]
H-4	Not Permitted	175[c]
H-5	Not Permitted	200[c]
I-2, I-3, I-4	Not Permitted	200[c]

Per PBC 1018.4, exception 2, dead end corridors are not allowed to exceed 50 feet when the building is fully sprinklered in an R-2 occupancy.

NFPA 101:7.5.1.5 requires exit access to be arranged so there are no dead ends in the corridors unless permitted. A common path is the portion of the egress path which leads to an option of one or two exits. A dead end is a corridor along the exit path that does not lead to the exit and delays egress.

Table 21 summarizes the common path and travel distances in the building. All of the common paths and dead ends meet the requirements of PBC Chapter 10.

TABLE 21. SUMMARY OF COMMON PATH AND TRAVEL DISTANCE

Floor	Area	Common Path (feet)	Travel Distance (feet)
Basement	A. Mechanical Areas	50	80
	B. Mechanical Areas	45	85
	C. Mechanical Areas	43	75
	D. Mechanical Areas	27	52
	E. Mechanical Areas	18	60
Ground	A. Café	0	66
	B. RA Suites	34	93
	C. Offices	100	104
	D. West Exit	93	93
	D. East Exit thru Corridor	66	150
	E. Shops/Mercantile	0	45
	F. Coffee Shop	0	39
North Tower	Room to Stair 3	20	110
	Room to Stair 4	20	130
South Tower	Room to Stair 1	20	120
	Room to Stair 2	20	120

EGRESS COMPONENTS

The egress components for the ground floor are illustrated below in Figure 24 showing egress components in addition to fire resistant assemblies and exit signs. A 45-foot dead end corridor exists in the basement extending from the entrance of the south exit stair to the elevator (not shown). On the ground floor there is a 20-foot dead end corridor in the main elevator lobby. This is mitigated by a card access gate system for residents. There is an 8-foot dead end corridor located in the Office area. All other components on the

ground (and basement) floors meet the requirements put forth by PBC Chapter 10 and NFPA 101.

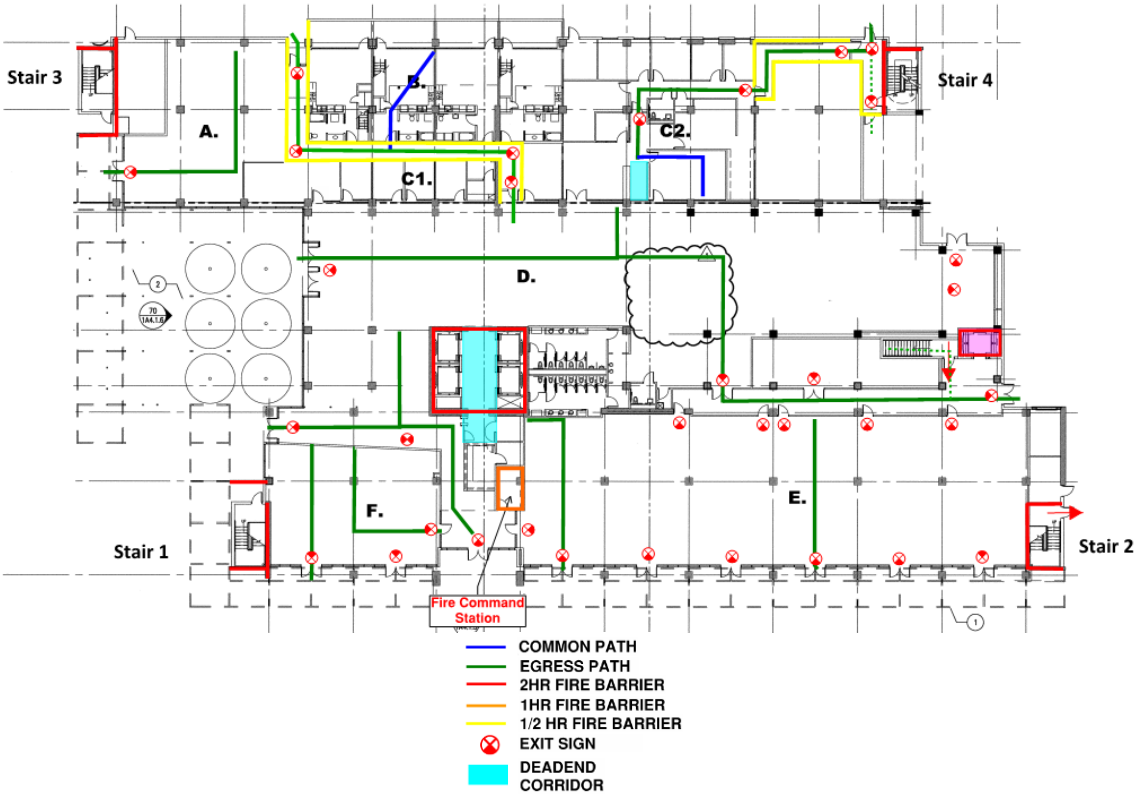


FIGURE 24. GROUND FLOOR - COMMON PATH, TRAVEL DISTANCE, AND DEAD END CORRIDORS

The egress components for a typical dormitory floor is illustrated below in Figure 25 showing egress components in addition to fire resistant assemblies and exit signs.

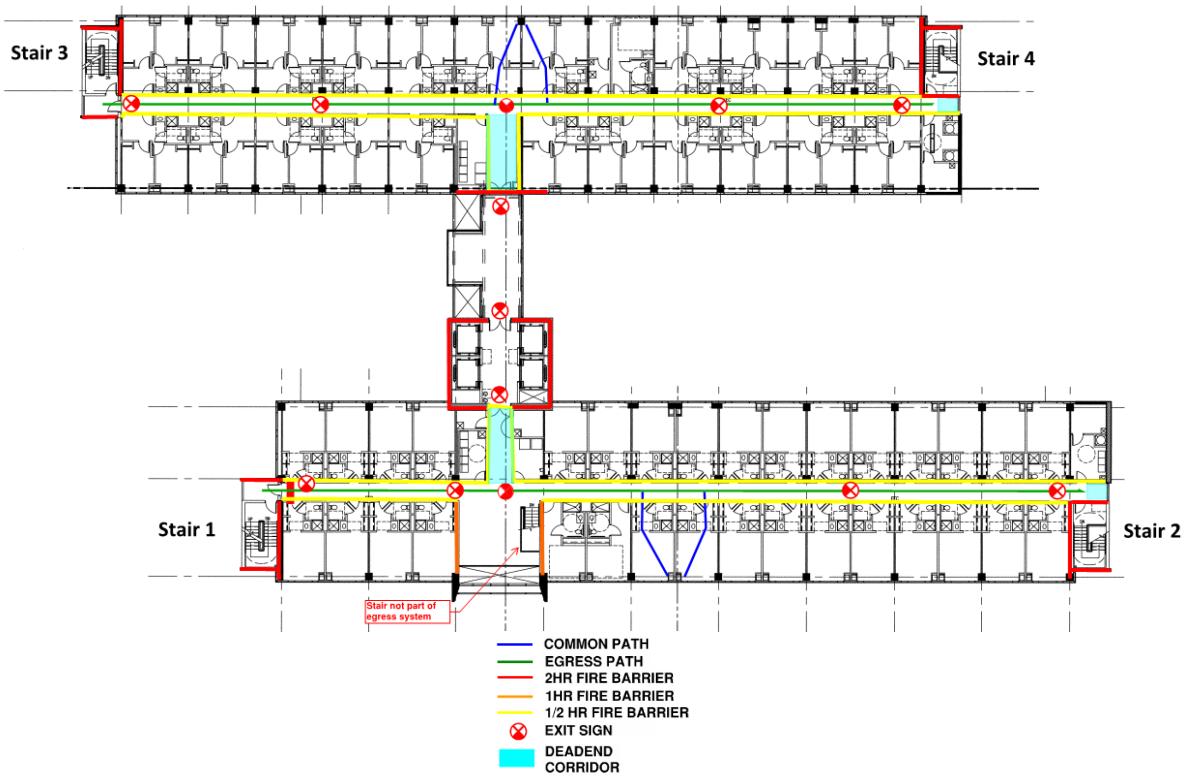


FIGURE 25. TOWER FLOOR - COMMON PATH, TRAVEL DISTANCE, AND DEAD END CORRIDORS

In South Tower a 20-foot dead end corridor exists between the main corridor for the floor and the entrance to the tower bridge doors. There is a short dead end of 5 feet at the end of the main corridor near the stair 4 entrance. In North Tower a 20-foot dead end corridor exists between the main corridor for the floor and the entrance to the tower bridge doors. There is a short dead end of 5 foot at the end of the main corridor near the stair 2 entrance. The assembly area located in the towers near the convenience stair can be considered a dead end as it is approx. 20-foot long. In all cases, the dead end corridor distance does not exceed the maximum allowable distance. All other egress components meet the requirements put forth by PBC Chapter 10 and NFPA 101.

EXIT SIGNS AND EXIT ILLUMINATION

Illuminated exit signs are required by PBC Chapter 10 to be provided at exit doors and where otherwise necessary to clearly indicate the direction of exit travel when the egress

path is not continuous. Exit signs were indicated at the front entrances of the six mercantile suites because the future build out may obscure the signs. Per PBC 1011.1, exit signs are placed per manufacturers recommended spacing but no more than 100 feet apart. This meets city code and increases safety, so additional signs were added to the plan. The exit signs are illuminated at all times the building is occupied. The light intensity is not to be less than 1-foot candle at the floor. The power for exit signage and exit illumination is normally supplied from the premises wiring. Emergency power is provided by integral batteries or the on-site generator.

OCCUPANT CHARACTERISTICS

Resident Assistants are assigned shifts and live on the ground floor of the facility. These individuals are familiar with the building layout and procedures. They will assist in evacuation, but not be responsible for handling fire protection equipment or fire extinguishers.

Office Staff are assigned shifts and are present during normal business hours. These individuals are familiar with the building layout and procedures. They assist in evacuation, but are not be responsible for handling fire protection equipment or fire extinguishers.

Security Officers are assigned shifts and work from the security office located on the ground floor of the facility. These individuals are deeply familiar with the building layout and procedures. They can assist in evacuation, and may be responsible for handling fire protection equipment and starting the fire pump.

Maintenance Techs are assigned shifts and are onsite 24 hours a day. These individuals are familiar with the building layout and procedures. They are responsible for assisting with fire protection equipment and starting or stopping equipment as requested by local fire officials.

Janitorial Staff are assigned shifts and work onsite 24 hours a day. These individuals are familiar with the building layout and procedures.

Students live in the dormitory towers 1 and 2. These individuals are familiar with the building layout and some procedures. They are not responsible for handling fire protection equipment. Students in the building may be impaired by drugs or alcohol and may require additional assistance to leave the building. These individuals can be disruptive to egress and may have to be rescued for refuge areas. A portion of the population is likely ignore the alarms and security or the Fire Department will have to go room by room to clear each floor.

Mobility Impaired Students are housed in the towers in ADA designated rooms. These individuals are familiar with the building, but will need to be aware of the refuge areas located in each tower, and the ability to shelter in place in the event of an emergency.

Café and Mercantile staff are located on the lower levels and exit directly out onto the ground level.

EGRESS MOVEMENT AND TIME

PRE-MOVEMENT

The calculation of evacuation times through doors and down stairs is relatively straightforward to calculate. It is the time before the occupant makes it to the door to their room or the time to recognize the hazard and decide to locate and head toward an exit that is difficult to assess.

The SFPE 4th edition Handbook, Table 4.2.1 on Delay Times Derived from Actual Fires there are four mid-rise and three high rise apartment fires that give indications of delay times. The mid-rise fires had a median delay for good alarm action of 1.4 minutes, and a median delay range of 2.5-7.7 minutes with poor alarm performance. The high rise fires ranged from 1.3-8.0 minutes with weather and time of day affecting the later delay times.

The SFPE Handbook associates a lower delay time with an informative warning displays, trained staff, and voice evacuation. There is trained staff onsite and 24-hour security officers to aid in evacuation. The delay time used for pre-movement time is 120 seconds based on the SFPE Table.

In occupancies where sleeping occurs there is always the risk of someone sleeping deeply due to excessive studying (or drinking). These occupants could be less likely to react quickly to an alarm otherwise everyone can be considered able bodied. A positive factor is the arrangement of the building. Having one main corridor for each tower reduces confusion about which way to go, opportunities for notifying others on the way, and communicating with others. If the alarm activates at 3am, a quick peek out the door into the hall will confirm if others are actively leaving, and possibly provide information on validity of the alarm.

For the ground floor, the SFPE 4th edition Handbook Table 4.2.1 on Delay Times Derived from Actual Fires identified a one story department store with pre-movement times of 45 seconds. A one story department store is very similar to the assembly occupancy on the ground floor with good visibility and higher than average ceilings this time was selected for the pre-movement time.

EGRESS TIME CALCULATIONS

The procedure provided in the 20th edition NFPA Handbook Section 4, Chapter 2 was used to calculate the egress times.

GROUND FLOOR EGRESS

To provide a basis for further calculations, the egress time was calculated for the evacuation of the ground floor. The ground floor egress components are four double doors, and a corridor with a single entry and exit door. The double doors were replaced by single doors at some point in the design process. The occupant load for the egress analysis is taken from the combined occupant load in Figure 26.

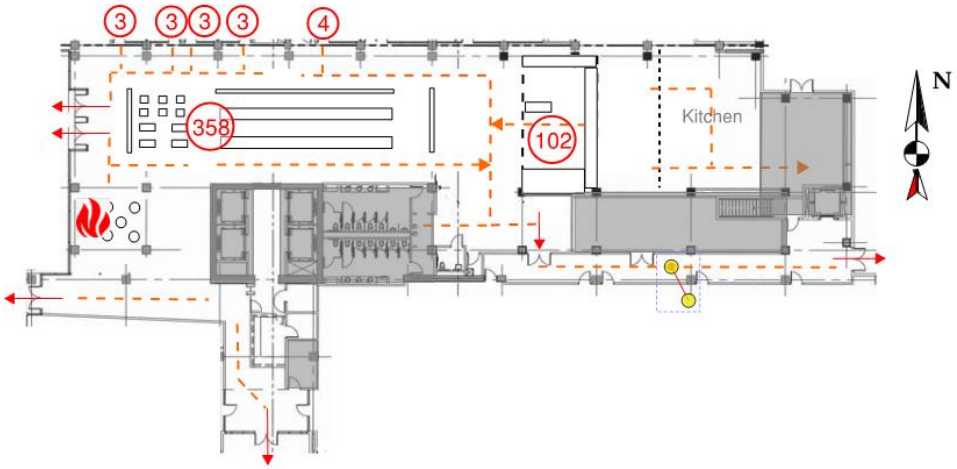


FIGURE 26. OCCUPANT LOAD DETAILS

Based on NFPA Handbook, Table 4.2.4, the effective widths are calculated as follows:

Assembly Doors	(72”)	We = 72” – 4(6”) = 48” (4.00 feet)
Corridor Entrance Door	(36”)	We = 36” – 2(6”) = 24” (2.00 feet)
South Corridor	(65”)	We = 65” – 2(8”) = 49” (4.08 feet)
Corridor Exit Door	(36”)	We = 36” – 2(6”) = 24” (2.00 feet)

The flow capability of the assembly double doors was calculated from NFPA Handbook, Table 4.2.8.

Fsm = (24.0 persons/min/foot)
Fs = Fsm
Fc = Fs · We = (24.0)(4.00) = 96.0 persons/min

Where:
Fsm = maximum specific flow
Fs = specific flow
Fc = Calculated flow

The flow capability of the corridor door was calculated from NFPA Handbook, Table 4.2.8.
Fsm = (24.0 persons/min/foot)
Fs = Fsm
Fc = Fs · We = (24.0)(2.00) = 48.0 persons/min

The effect of restricted flow from corridor to egress door was calculated, resulting in the maximum specific flow of the door still limiting the exit capacity.
Fs (door) = [Fs(corridor) · We (corridor)]/ We (door)
Fs (door) = (54 · 4.08) / 2 = 110.3 persons/foot
Fsm (door) < Fs (door) so Fsm is used.

The speed of movement in the corridor was based on an occupant density given the entry and exit restriction of 48 persons per minute.
Fsm = (24.0 persons/min/foot)
Fs = Fsm
Fc = Fs · We = (24.0) (4.08) = 98.0 persons/min
Entry and exit doors of corridor still restrict egress.

The required movement time to exit the ground floor is calculated as follows:
(476 occupants) / ((4)96+48 occupants / min) = 1.10 min = 66 s

The pre-movement time and alarm time adds more time to the egress time as discussed previously. During normal hours at peak occupancy, visual fire detection could occur within 15 seconds and result in the activation of a pull station within 30 seconds of travel time. Recognition and response time is short due to the occupants observing the fire directly or as smoke spreads through the space. The occupants in the rear of the assembly area near the kitchen would likely be delayed. The travel distance to the exit doors is short and in most cases does not exceed 100 feet. Based on an even division of occupants to the exit doors, total time to evacuate the ground floor with alarm is 66 seconds.

TOWER EGRESS

A full evacuation from the south tower was calculated to develop a baseline egress time if the entire building needed to be evacuated based on a bomb threat or another catastrophic event. The tower corridors are 54 inches wide and doors discharging into the

stairs are 36 inches wide. Based on NFPA Handbook, Table 4.2.4, the effective widths are calculated as follows:

Stair	49.5”	We = 49.5” – 2(6”) = 37.5” (3.13foot)
Door	36”	We = 36” – 2(6”) = 24” (2.00foot)
Corridor	54”	We = 54” – 2(8”) = 38” (3.17foot)

The flow capability of the stair was calculated from NFPA Handbook, Table 4.2.8. The stair has a typical 7/11 step.

Fsm = (18.5 persons/min/foot)
Fs = Fsm
Fc = Fs · We = (18.5) (3.13) = 57.8 persons/min

The flow capability of the stair and corridor door was calculated from NFPA Handbook, Table 4.2.8.

Fsm = (24.0 persons/min/foot)
Fs = Fsm
Fc = Fs · We = (24.0) (2.00) = 48.0 persons/min

The calculated flow of the door is 48.0 persons per minute which is less than the 57.8 persons per minute making the door the limiting factor on exit capacity.

The effect of restricted flow from corridor to egress door was calculated, resulting in the maximum specific flow of the door still limiting the exit capacity.

Fs (door) = [Fs(corridor) · We (corridor)]/ We (door)
Fs (door) = (54 · 3.17) / 2 = 85.5 persons/foot
Fsm (door) < Fs (door) so Fsm is used.

The effect of merged flow on stair at each floor door was also calculated and found to be greater than the maximum specific flow of the door limiting the exit capacity.

Fs (stair out) = {[Fs(door) · We (door)] + [Fs (stair in) · We (stair in)]} / We (stair out)
Fs (stair out) = ((43.9 · 1.83) + (49.2 · 2.66)) / 2.66 = 79.40 persons/foot
Fsm (stair) < Fs (stair out) so Fsm is used.

The effect of merged flow on stair between first and basement floor was excluded from the calculation because there are two exits from the basement area and the occupant load is low. The stair from the ground floor to the second floor is two stories and any occupants egressing from the basement reach ground level before the second floor is half way thru the stair.

The speed of movement in the corridor was based on worst occupant density and

calculated as follows:

((194 people)/2) / ((4.5 feet) (120 feet) = 0.180 people per square foot

Density conditions close to maximum flow per NFPA Handbook 4.6, p60-61.

$S=k - a \cdot k \cdot D = 212 – (2.86) (212) (0.180) = 102.8 = 103$ feet per minute

The time to travel a flight of stairs is based on a floor elevation of 9 feet and 7/11 typical stair, and calculated as follows:

Conversion factor per NFPA Hbk. Table 4.2.6.

Stair (9.0 feet) (1.85) = 17.02 feet = 17 feet

Landing 9.3 foot

Total travel distance = 17.0 feet + 2(9.3 feet) = 35.6 feet

(35.6 feet)/ (103 feet /min) = 0.346 minutes to travel stair

The required time to exit the floor is calculated as follows:

(194 occup.)/ (48.0 occup/min) = (4.04 min/2 stairs) = 2.02 min = 121 s

2.02 min + 0.346 min = 2.37 min = 141 seconds to exit the floor

The estimated persons in the stair using travel time and egress capacity is:

(194 persons/floor) · (floor/2 stair) = 97 persons per stair

(0.346 minutes) · (48 persons/min) = 16.6 = 16 persons in one stair

(16 persons/floors) · (12 floors) = 192 persons in one stairwell.

Remaining 81 occupants on floor in que at the stair door at t=0.346 minutes.

When stair is filled, the egress time is restricted by the 36” stairway discharge door with a rate of discharge of 48.0 persons per minute. Entry into the stair is restricted by a 36” doors as well limiting entrance into the stair and creating a que in the corridor. The assumed evacuation method is that the building is evacuated from the top down. This is based on the NFPA Handbook and example 4.6 that the building is evacuated from the top down.

The merging flow from the exit door does not restrict the flow in the stairwell since it is still regulated by the maximum specific flow of the door. As discussed in the previous section, 120 seconds of pre-movement and movement time was selected from SFPE Handbook Table 4.2.1. It is a small building and exit paths are approximately 120 feet long with a 2-3 feet per second travel speed plus time to gather personal belongings. Remaining 76 occupants exit at a rate of 48 occupants per minute. The limitations of this analysis is that it uses only the South Tower occupant load which is larger than the North Tower occupant load and exit at a slightly higher rate.

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The total time to evacuate the all floors simultaneously in the South Tower by floor is shown in Table 22. This includes time to travel to the stairs and thru the stairs to the ground level. This is information is not critical, but important to identify an approximate full evacuation time to compare with the actual full evacuation time during a fire drill.

TABLE 22. FULL EVACUATION OF THE SOUTH TOWER

Actions	Time (s)	Rtotal (s)
Start Evacuation	0	0
Pre-movement Time	120	
13th Occupants Reach stair	120	120
13th Occupants Fill stair	20.76	140.76
12th Occupants in Stair	121.00	261.76
12th floor stair empty	20.76	282.52
11th Occupants in Stair	121.00	403.52
11th floor stair empty	20.76	403.52
10th Occupants in Stair	121.00	524.52
10th floor stair empty	20.76	545.28
9th Occupants in stair	121.00	666.28
9th floor stair empty	20.76	687.04
8th Occupants in Stair	121.00	808.04
8th floor stair empty	20.76	828.80
7th Occupants in Stair	121.00	949.80
7th floor stair empty	20.76	970.56
6th Occupants in Stair	121.00	1091.56
6th floor stair empty	20.76	1112.32
5th Occupants in Stair	121.00	1233.32
5th floor stair empty	20.76	1254.08
4th Occupants in Stair	121.00	1375.08
4th floor stair empty	20.76	1395.84
3rd Occupants in Stair	121.00	1516.84
3rd floor stair empty	20.76	1537.60
2nd Occupants in Stair	121.00	1658.60
2nd floor stair empty	41.52	1700.12

Note:
1. Ignoring second half of staircase at ground level for 2nd floor stair fill calculation.
2. This analysis uses only South Tower occupant load North Tower occupant load is lower and will exit at a slightly faster rate.

Total time to evacuate floors 2-12 is 1700.1 seconds, or 28.3 minutes.

SMOKE CONTROL AND MANAGEMENT

EXIT STAIRWAYS

Taylor place is a high rise exceeding 75 feet above the lowest level of fire department vehicle access the building. PBC section 403.5.4 requires every required exit stairway serving floors above 75 feet above the lowest level are required to be smoke proof enclosures or pressurized stairways in accordance with PBC 1022.10.

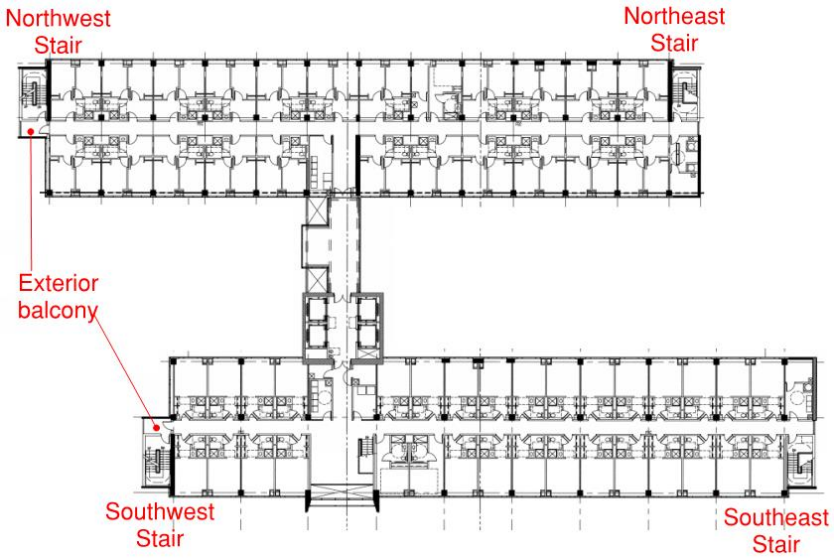

FIGURE 27. PLAN VIEW OF STAIRWELLS

The four tower stairwells are of two basic designs and identified in Figure 27. The west stairwell smokeproof enclosures are accessed by an open exterior balcony per PFC 1022.10.2. Since the access to the stairwell enclosure is on is exterior of the building, the potential for smoke transfer is greatly reduced and a pressurization system is not required. The east stairwell smokeproof enclosures are directly connected to the building and per PFC 1022.10.2 and by exception, the stairwell is pressurized complying with PFC Section 909.20.5.

STAIR PRESSURIZATION

The stairwell pressurization was determined using the Section 909 Smoke Control Systems and the ASHRAE Handbook of Smoke Control Engineering. A rational analysis was performed

A single injection system was chosen with a propeller fan located at the top of the east stair wells. Single injection systems can fail if too many doors are open and a more detailed CFD

analysis may be necessary due to the height of the stairwells. However, this is still the preferred system due to its simplicity and its positive impact on stack effect. A pressure relief damper is provided at the base of the stairwell to prevent over pressurization.

Initiation of the smoke pressurization system is by manual controls in the fire command center or by sprinkler waterflow as required by PFC 909.12.2. The systems are powered by two sources: normal building power and a standby source of power provided by the generator. The fire fighters control panel provides a diagram and indication of operation per PFC 909.16 and control over the entire system as specified in PFC 909.16.2.

The calculations for the ventilation rate to pressurize the stairwells were based on the ASHRAE Handbook of Smoke Control Engineering (HSCE) and are provided in detail in the Appendix. Climatic Data was taken from Table 2.1 of the HSCE for Phoenix Sky Harbor Airport in Phoenix, Arizona. The elevation is 1,106 feet, pressure was 14.12 psi, a winter temperature of 110.2 degrees Fahrenheit, and a summer temperature of 38.6 degrees Fahrenheit. The flow areas ad leakage rates were taken from HSCE Table 10.1. The minimum and maximum design pressure differences were 0.10 and 0.35 inH2O respectively. The calculated summer design airflow rates were 10,534 cubic feet per minute, and the calculated winter design airflow rates were 9,233 feet per minute using the minimum design air pressure of 0.10 inH2O using untreated area. The maximum air pressure difference permissible based on the 36-inch door is 0.41 inH2O using the equation provided in PFC 909.6.2.

SMOKE REMOVAL

As required by PBC Section 403.4.6, smoke removal for overhaul operations will be provided in the form of fixed glazing to be cleared by fire fighters per Exception 2.

In addition, doors on each floor can be opened to provide venting through the elevator lobby to the bridge and stairways. No mechanical smoke removal systems are required.

INSPECTION, TESTING, AND MAINTENANCE (ITM)

NFPA 92 – STANDARD FOR SMOKE CONTROL SYSTEMS

NFPA 92 *Standard for Smoke Control Systems* is the basis for all maintenance programs for ITM of the smoke control and management systems. A summary of the requirements is provided in the Appendix.

EQUIPMENT AND TOOLS

Any specialized tools for maintaining and testing fire protection, fire alarm, smoke detection, or other fire protection equipment is maintained on site.

CONCLUSION (MEANS OF EGRESS)

Based on a prescriptive evaluation of the building, it is in compliance with Chapter 10 of the PBC and the applicable chapters of NFPA 101 as identified in this sections introduction.

The occupant loads for each area were calculated according to PBC Chapter 10 and the resulting loads were assigned to the available exits on each level. Common path, dead ends, and travel distance were all analyzed and measured. All exits are remotely located on the ground floor on each side of the building, and on opposite ends of each tower. Egress capacity was adequate for the occupant loads.

As discussed previously, the connecting bridge is not part of the egress system, but is an option if no other egress path is available. Occupant characteristics were considered in the evaluation of egress times from the ground floor and towers. This was not a complete egress analysis of all occupant loads, but a representative analysis using the worst case floors and largest groups of occupants. The roof is a non-occupied area and was excluded from these calculations.

The area of concern is egress from the towers and the assembly areas which are discussed in more detailed in the performance based section. Additional signage is recommended for the corridors since the location of the common area divides the floors into east and west sides. Occupants in the east corridor may choose the east exit when the west exit is actually closer. The occupant load of the assembly area of 51 total occupants was not calculated as part of the floor load in the calculations which is an error. Egress capacity is available, but the total egress time should be extended an additional 32 seconds.

12. PERFORMANCE BASED VALIDATION

INTRODUCTION

Based on NFPA 101 and Chapter 5 Performance Based Option, two design scenarios were chosen to challenge the building and the ability to egress occupants from occupied spaces. Two scenarios were selected in the South Tower and in the main assembly space on the ground floor. The design scenarios are discussed below.

METHODOLOGY TO EVALUATE THE PERFORMANCE OBJECTIVES IN NFPA 101

To properly evaluate the performance criteria scenarios, need to be developed analyze the possible outcomes and compare against the performance criteria. The basic process is described in NFPA 101: 5.2, with additional information in the SFPE Handbook and in the NFPA Handbook.

From the NFPA 101 Handbook, the flow chart in Figure 24 is a suggested method to use for a performance based approach.

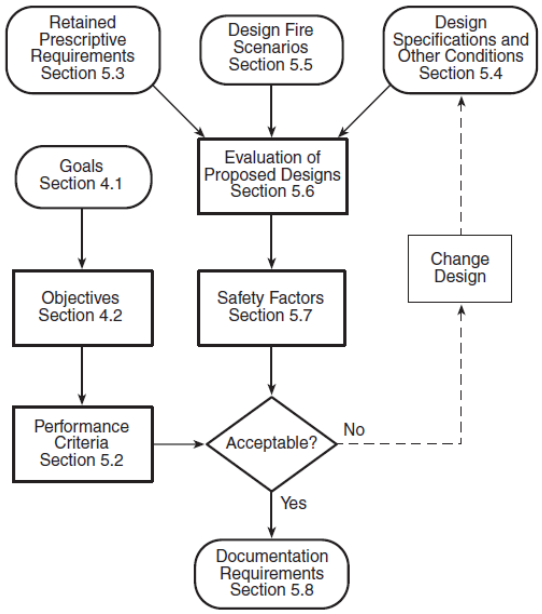

FIGURE 28. PERFORMANCE BASED LIFE SAFETY CODE COMPLIANCE FROM NFPA 101 A-5.1.1

This method was followed based on the NFPA 101 flowchart in Figure 28.

1. The building design is retaining the prescriptive elements as described earlier in the report per NFPA 101 5.3. This includes the fire protection, building features, means of egress, and applicable NFPA codes and standards.

2. The design fire scenarios were developed based on NPFA 101 5.5 requirements and are as follows:

    a. Design fire scenario one is an analysis of the South Tower based on NFPA 5.5.3.1 and a typical fire for the occupancy accounting for occupants, number and location, room sizes, contents, fuel properties, ventilations, and identifying the location of the item ignited. This is a chair fire that is ignited by a smoldering source in the common area on the lower floor of the two-story space.

    b. Design fire scenario two is an analysis of the Ground Floor Cafeteria and Assembly Area based on NFPA 5.5.3.2 and an ultra-fast fire in the primary means of egress reducing the overall means of egress by two double door exits. This is an ultrafast fire based on a Douglas fir tree used as a Christmas tree.

3. Per NFPA 5.4, there were no changes to the construction, fire protection features, or egress for this analysis. Occupant characteristics have not changed from what has been described previously.

    The time of day for each scenario is a specification to evaluate the design at the highest occupant loads, or during the least occupied times to achieve the worst potential conditions for the evaluation.

    a. Design fire scenario one was analyzed based on a fire occurring during the night, or a time when the common area was not fully occupied.

    b. Design fire scenario two occurs during the day when the space is occupied and the occupant load is close to the calculated values.

4. The goal is established per NFPA 101, section 4.1 to protect the occupants and provide safe egress.

5. The objectives per NFPA 101 section 4.2 are to protect the occupants with a structure designed to allow safe egress and protect occupants who are not intimate with the initial fire time to evacuate.
6. The performance criteria established for the scenarios per NFPA 101 section 5.2 is

based on tenability criteria to determine if with the given the design fire, all occupants can exit safely using an analysis of Acceptable Safe Egress Time (ASET) and the Required Safe Egress Time (RSET). The tenability criteria are visibility, carbon monoxide, and temperature (hyperthermia).

7. The prescriptive elements, design fire scenarios, and specifications with the performance criteria was presented to the Authority Having Jurisdiction (AHJ) for review and comment. After discussing the performance based approach, the AHJ approved the scenarios and performance criteria.

8. The design fire scenarios were evaluated using Fire Dynamics Simulator (FDS) versions 6.0 with models created from the building design. The results of the FDS simulation provided tenability results that were coupled with the egress analysis to determine the Acceptable Safe Egress Time (ASET) and the Required Safe Egress Time (RSET).

9. The results were compared to performance criteria, and an iterative process takes place to revise the trial designs and if needed the objectives can be redefined if it is not possible to find a viable design.

10. If the trial designs meet the performance criteria, the final design is selected.

The following method is discussed in detail in the following sections. The scenarios were evaluated multiple times each until an acceptable outcome was found where the ASET exceeded the RSET with an acceptable margin of safety.

TENABILITY

Tenability criteria was selected from The Society of Fire Protection Engineers (SFPE) Handbook 4th Edition which serves as a design guide to Fire Protection Engineers. The performance criteria of visibility, carbon monoxide poisoning, and temperature exposure are common limits to assist in defining when a space is not tenable.

1. Visibility at height of 1.8m above floor per SFPE Handbook Table 2-6.11, s required to be maintained at an optical density of OD/m 0.08 (10m visibility) for a large enclosure, and an OD/m 0.2 (5m visibility) for a small enclosure. Testing and analysis has shown that 30% of occupants turn back rather than enter smoke with a visibility at 4m typically leading to death.

2. Carbon Monoxide concentrations at height of 1.8m above floor per SFPE Handbook Table 2-6B are required to be maintained at a maximum of 1,700 ppm leads to incapacitation in 30 minutes.

3. Temperature at height of 1.8m above floor per SFPE Handbook Table 2-6.17 and Figure 29 is required to be maintained at 110 °C for 25 minutes, or 70 °C for 60 minutes to avoid the effects of hyperthermia. The goal is to maintain upright egress if possible.

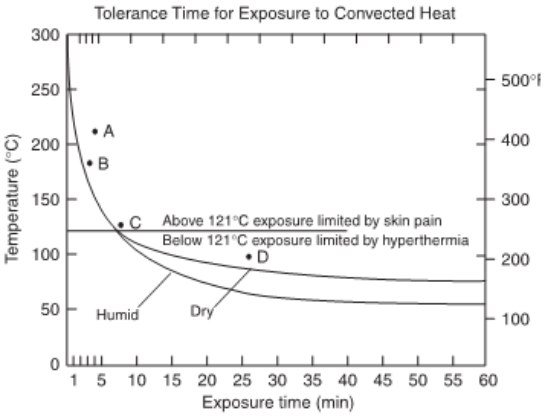

FIGURE 29. THERMAL TOLERANCE FROM SFPE FIGURE 2-6.27

USE AND LIMITATIONS

This analysis is an estimate of the time to evacuate the building based on engineering and accepted design methods. It is not a precise number as any number of factors from time of day to weather can have an effect on the overall time. This is a student dorm and the day after a popular football game could leave a large population of the tenants reacting slowly to any emergency situations.

The analysis is limited to being as estimation of the best possible conditions. It does not directly address the rescue of a mobility impaired individual on the fire floor. This would require a fire fighter to ascend the staircase against the flow, rescue the individual, and descend the stairwell.

SMOKE DETECTOR ACTUATION AND DETACT

Smoke detection performance was analyzed to assist in the calculation of the available and required egress times for a few scenarios consistent with the egress analysis. The scenarios presented are a dormitory room fire alerting the occupants, a chair fire in the common area with one based on the initial design fire scenario.

The DETACT model, or DETector ACTuation Time Squared model is used to estimate the actuation of detection devices based on a t-squared fire. The model will estimate the device actuation using transport equations, temperature, and the response time index (RTI). In our models for smoke detectors, criteria are used relating the activation of smoke detectors with heat detectors. For the smoke detection models, Actuation temperatures of 30 degrees Celsius and an RTI of 5 $m\text{-}s^{1/2}$ were based on NFPA 72 Annex B and Table B.4.7.5.3.

SMOKE DETECTION PERFORMANCE - ROOM SCENARIO

In the SFPE Handbook Chapter 3 provides heat release rates (HRR) for mattress fires. There are a number of variables involved including mattress composition and thickness and no clear standard heat release rate. Peak heat release rates for these fires can vary from 19kW to 2,550kW.

The DETACT model calculation input parameters are shown in Table 23 for the room fire scenario. Radial distance in Table below is based on the size of the dormitory room.

TABLE 23. DETACT INPUT PARAMETERS AND RESULTS – DORMITORY ROOM

INPUT PARAMETERS			CALCULATED PARAMETERS		
Calculation reset	1	0 or 1	R/H	2.4	-
Ceiling height (H)	2.5	m	W/H	1.44	-
Room width (W)	3.6	m	Temperature factor	0.212369121	-
Radial distance (R)	6	m	Velocity factor	0.23024269	-
Ambient temperature (To)	24	C	Calculation time (t)	2401	s
Actuation temperature (Ta)	30	C	Fire HRR (Q)	270945.647	kW
Rate of rise rating (ROR)	0	C/min	Gas temperature (Tg)	3287.368965	C
Response time index (RTI)	5	(m-s)1/2	Gas velocity (Ug)	10.97741055	m/s
Fire growth power (n)	2	-	ROR at detector	108.7412117	C/min
Fire growth coefficient (k)	0.047	kW/s^n	Detector temp (Td)	3286.446283	C
Fire location factor (kLF)	1	-	Detection trigger	2374	2400

Representative t2 coeff.	k
Slow	0.003
Medium	0.012
Fast	0.047
Ultrafast	0.188

CALCULATION RESULTS	FT	ROR	
Transport lag time (tl)	28	28	s
Detection time (td)	28	2	s
HRR at detection (Qd)	37	0	kW
HRR w/transport lag (Ql+d)	147	42	kW

< Press PgDn key for additional results >

Calculation time (s)	HRR	Gas temp	Det. temp
0	0	24	24
101	479	72	70
201	1899	144	142
301	4258	229	227
401	7558	324	322

For a typical fire in a dorm room, the time for smoke detector activation at 30°C is approx. 25 seconds with a HRR of approx. 32kW. Tracing the detector activation on Figure 30 provides similar results. Activation is fast as expected, with the gas temperature and detector temperature closely following each other as there is minimal thermal lag in the detector.

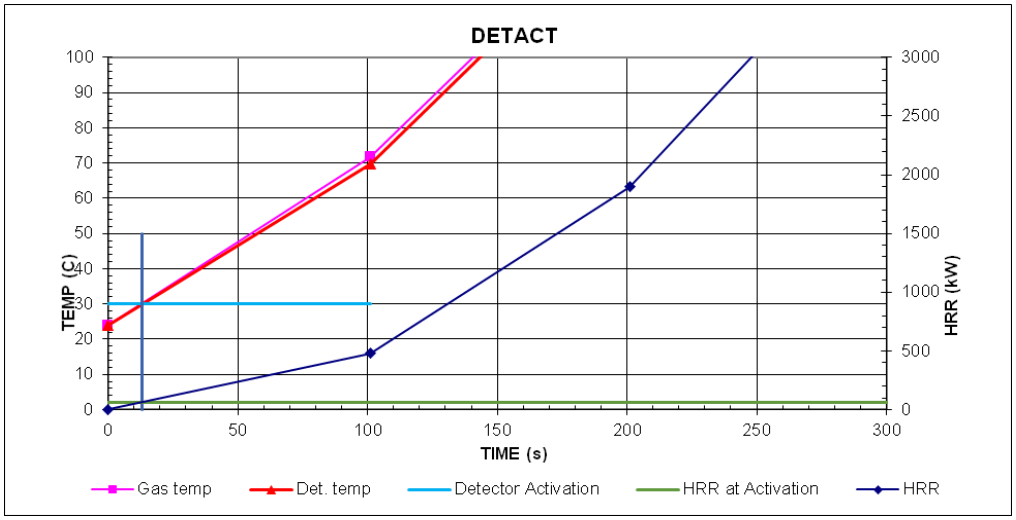

FIGURE 30. DETACT CURVE FOR CHAIR IN DORM ROOM

SMOKE DETECTION PERFORMANCE – POLYUERETHANE CHAIR FIRE IN COMMON AREA

The SFPE Handbook Chapter 3 provides information on furniture fire heat release rates (HRR). Test specimen 21 is a chair with flexible polyurethane foam. Peak heat release rates for this fire were 2,000 kW per Figure 3-1.52. Other input parameters are in Table 24.

TABLE 24. DETACT INPUT PARAMETERS AND RESULTS – CHAIR FIRE IN COMMON AREA

INPUT PARAMETERS			CALCULATED PARAMETERS		
Calculation reset	1	0 or 1	R/H	1.3	-
Ceiling height (H)	2.5	m	W/H	3	-
Room width (W)	7.5	m	Temperature factor	0.251859896	-
Radial distance (R)	3.25	m	Velocity factor	0.160722694	-
Ambient temperature (To)	24	C	Calculation time (t)	901	s
Actuation temperature (Ta)	30	C	Fire HRR (Q)	38154.647	kW
Rate of rise rating (ROR)	0	C/min	Gas temperature (Tg)	1071.556212	C
Response time index (RTI)	5	(m-s)1/2	Gas velocity (Ug)	3.986695009	m/s
Fire growth power (n)	2	-	ROR at detector	93.03000951	C/min
Fire growth coefficient (k)	0.047	kW/s^n	Detector temp (Td)	1069.223999	C
Fire location factor (kLF)	1	-	Detection trigger	876	900

Representative t2 coeff.	k
Slow	0.003
Medium	0.012
Fast	0.047
Ultrafast	0.188

CALCULATION RESULTS	FT	ROR	
Transport lag time (tl)	16	16	s
Detection time (td)	26	2	s
HRR at detection (Qd)	32	0	kW
HRR w/transport lag (Ql+d)	82	15	kW

< Press PgDn key for additional results >

Calculation time (s)	HRR	Gas temp	Det. temp
0	0	24	24
101	479	81	77
201	1899	166	163
301	4258	267	264
401	7558	380	377

The fire scenario occurs on the lower floor of the two-story space, one of the common areas in the tower. An upholstered chair fire occurring on the 12th floor in the common area with activation of a smoke detector in the common area, or nearby corridor is a reasonable scenario. Activation of the smoke detector should be fast due to the low ceilings as indicated by DETACT with detection in approximately 26 seconds and a 32 kW. Charting a line in Figure 31 for the detector activation temperature on the chart gives a detector activation of approx. 23 seconds and a HRR of approx. 100 kW.

The chair identified as F21 was tested and accepted in accordance with California Technical Bulletin 117 which means the chair components were tested and fire retardants likely added to the polyurethane foam. In comparison, California Technical Bulletin 133 is a test of the entire chair assembly. The CA TB 133 test is focused on more of a smoldering ignition source which maybe more difficult to detect if it is a slow, smoldering fire. In the case of furniture constructed in accordance with CA TB 133, the test criteria are used to estimate fire growth, but the DETACT model and chair F21 is used as a conservative method to determine detection.

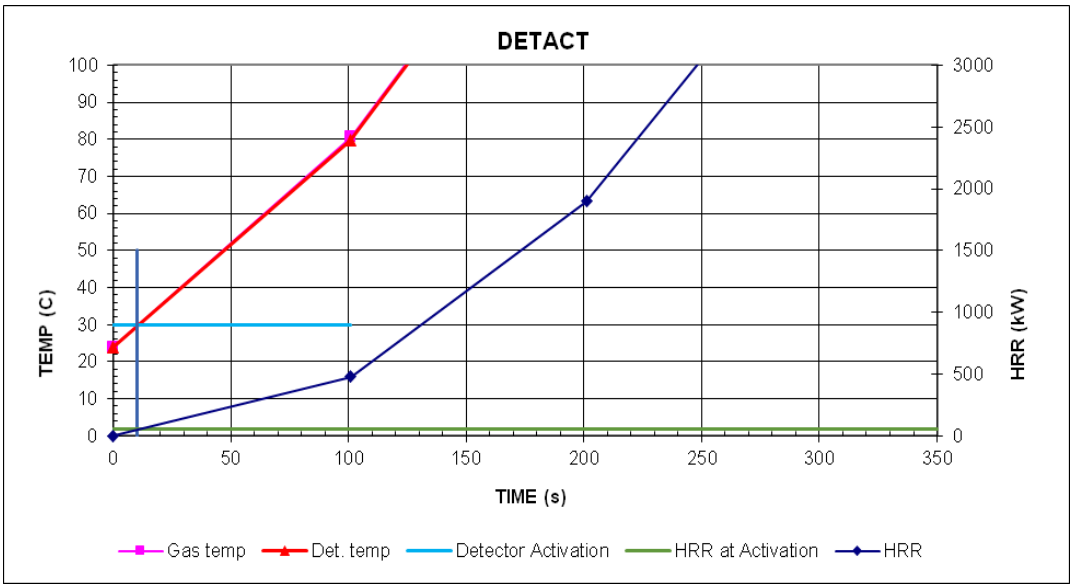

FIGURE 31. DETACT RESULTS – CHAIR FIRE IN COMMON AREA

DESIGN FIRE SCENARIO ONE

GROUND FLOOR ASSEMBLY SPACE

The main assembly area of the ground floor is occupied by students primarily during the day. It contains student services, the main entrance, study areas, a cafeteria and dining Tables with chairs. The design scenario selected from NFPA 101, section 5.5.3.2 incorporates the loss of exits forcing the occupants to seek alternative exits. The scenario incorporates a Douglas Fir Christmas tree located in a seating area near two main entrances. The ultrafast fire produces a peak heat release rate (HRR) of 3 megawatts in approximately 50 seconds. During normal hours of peak occupancy, the fire would be observed resulting in a manual pull station activation. Pre-movement time is relatively short given the visibility of the fire and smoke in the space reducing the recognition time.

EGRESS OF GROUND FLOOR WITH REDUCED EXITING

With the location of the fire in the seating area, the east exit adjacent to the coffee shop and the south exit near the security desks are expected to be inaccessible. Radiant heat flux was not calculated because of mostly non-combustible surfaces. Occupant loads and egress capacity is shown below in Figure 32 including the exits which were lost. Egress capacity was calculated using the clear width and a capacity factor of 0.15 inch per occupant based on the exception in PFC

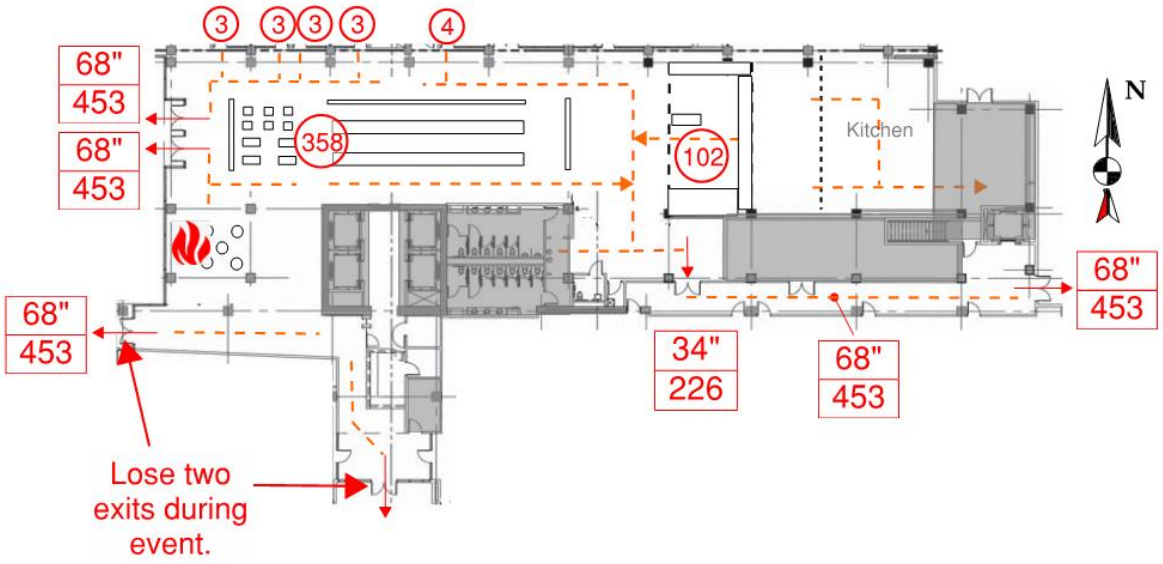

FIGURE 32. EGRESS PATHS AND EGRESS CAPACITY

The loss of the main south and south east double door exits leaves two double door exits available and the south corridor leading to the exterior of the building. The peak of the 2MW fire occurs in approximately 50 seconds with a surge of smoke pushing toward the cafeteria and kitchen. The population in the assembly area was divided equally between the east and west exits. A computational model was used to determine the behavior and movement of smoke in the space and is discussed later in the document. At peak heat release rate, a wave of smoke proceeds toward the café and kitchen. As it collides with the lentils and overhangs in the spaces it sends the smoke down toward the floor. Even then, visibility in the 18-foot-tall space is still acceptable making the western double door exits still a viable option until visibility in 50 percent of the assembly area drops below 10 meters.

FIRE DYNAMIC SIMULATOR (FDS) MODEL

The Ground floor assembly spaces were modeled in Pyrosim Revision 2015.4 and could easily be exported to be analyzed in FDS 6.0. The model included the spaces in Figure 30 above excluding the grey areas. The design fire as discussed above is a 2.1m tall Douglas Fir Tree used as a Christmas tree with a moisture content of approximately 20% based on the desert climate. Figure 33 shows the heat release rate (HRR) curve with the tree generating a peak heat release rate of 3,000 kW in approximately 50 seconds. The tree is located in the eastern portion of the assembly area as indicated earlier in Figure 32. Although the actual installation of a live Christmas tree is unlikely, the type of fire and HRR is well documented making it a good choice as a source versus a kiosk, or other source. This design fire has been approved by the Authority Having Jurisdiction (AHJ).

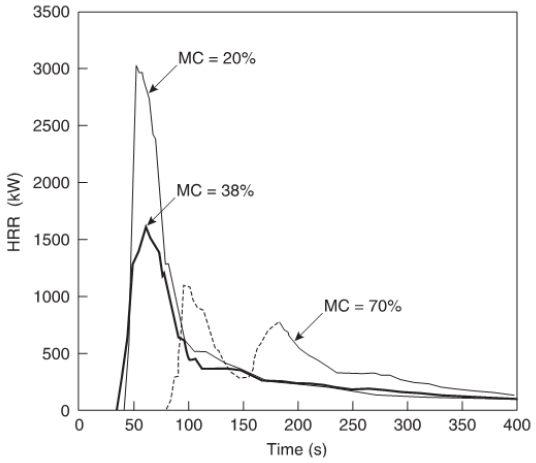

Figure 3-1.18. ***Typical HRR curves of Douglas fir Christmas trees.***

FIGURE 33. HEAT RELEASE RATE OF DOUGLAS FIR FROM SPFE HANDBOOK FIGURE 3-1.18

The FDS model consisted of 9 separate meshes to break up the model and allow for detailed modeling if necessary. This seemed to be beneficial using Open MP environment option as each mesh was assigned to a thread. The grid sizing was initially course and then reduce to a moderate size of 0.15m^3 to improve the simulation, although increasing computational time from hours to days. The type of combustion was expected to be flaming with 21% oxygen available yielding a carbon monoxide yield of 0.004% and a soot yield of 0.0010[1].

1 . *Table 1 - The Effects of Oxygen Concentration on CO and Smoke Produced by Flames*, Mullholland, et. al., 1991

Interior features of the space were modeled were they appeared to have a direct impact on the flow of heat and smoke at the ceiling level. Decorative chain curtains and elements were not modeled due to their potential for change due to remodel.

FDS RESULTS

The FDS model results were analyzed based primarily on the tenability criteria of visibility, carbon monoxide exposure, and temperature exposure. A general analysis of the behavior of the smoke was also made to predict its effect on occupants in the space. The results of the analysis were used to determine the values used in the ASET/RSET comparison.

Preliminary models were run and calculated the approximate activation of ceiling sprinklers in the model. The sprinklers were modeled as heat detectors with the activation of the second sprinkler used as the start of suppression. Based on the model results, the second sprinkler activates at approximately 47 seconds with the third and fourth sprinklers activating shortly after. At 47 seconds, the HRR of the fire was capped at approx. 2,000 kW. The graph of the heat release rate is shown in Figure 34. In this model the heat release rate was capped and then allowed to continue its original HRR. There was no testing, or documentation supporting this approach, but is an engineering assumption based on four sprinklers theoretically activating on a tree which would not restrict the movement of water through its branches would aid in the dispersion of water. The fire test indicated the heat release rate peaking over approx. 40 seconds and dropping to 500 kW by 100 seconds. Capping and maintaining a 2,000kW heat release rate is not likely to occur given the combustible mass available to burn in the Christmas tree.

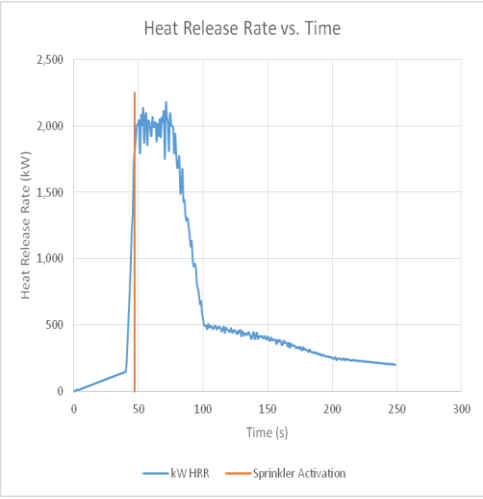

FIGURE 34. FDS HEAT RELEASE RATE OF DOUGLAS FIR TREE

When the model was created several slices were taken of the space and then viewed in smoke view with the simulation. The results were interesting especially with the moderate cell size used showing the flow of smoke around building features. The fire location is shown as a red square in Figure 35 with the extents of the model in yellow. Ceiling features are shown as wireframe boxes.

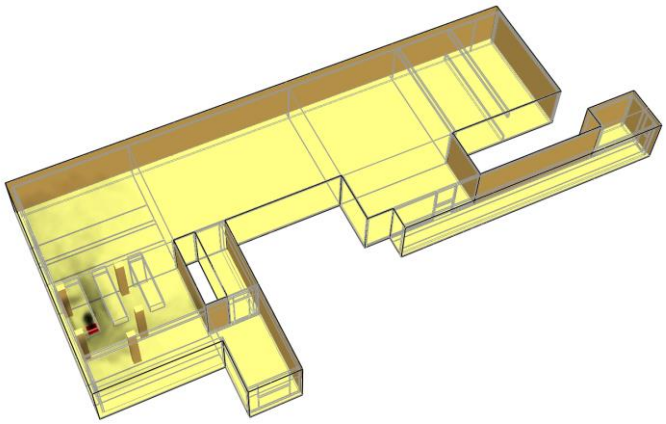

FIGURE 35. FDS MODEL RENDERING

The results of the FDS model shows tenability is maintained throughout the available safe egress time (ASET) of 400 seconds with respect to carbon monoxide and temperature, but not for visibility. In Figure 36, the yellow, orange, and red areas represent visibility in the range of 0.5m to 9.65m consuming a majority of the assembly area and total loss of the southern corridor.

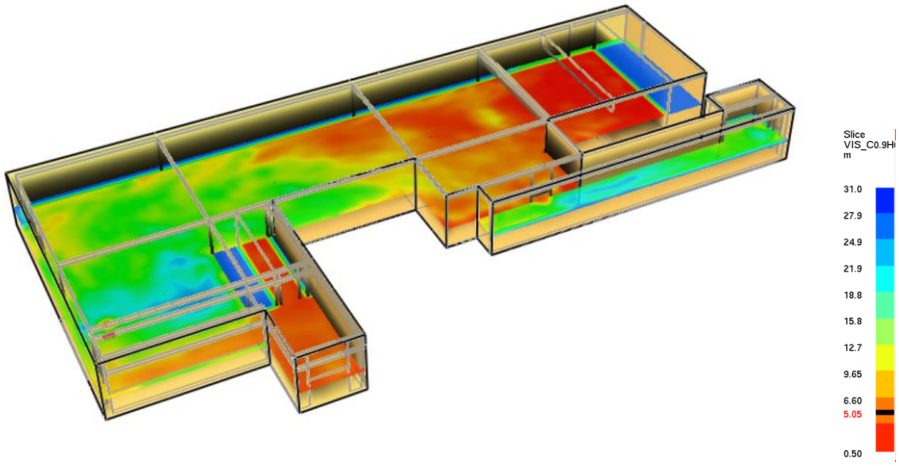

FIGURE 36. VISIBILITY AT 1.8 M ABOVE THE FLOOR AT 400 SECONDS

For the first floor, tenability is limited by visibility at 10.0m which is shown in Figure 37 at the Required Safe Egress Time of approx. 269 seconds in the food serving areas of the cafeteria shown in red. At this point the visibility is dropping below 5m which could lead to someone becoming lost and disoriented in the café, however this is also the time required to exit the building with all delays involved. At this point all occupants are queued at the door 10m visibility. Another location where visibility is lost is the elevator lobby, security desk, and entrance to the fire command center.

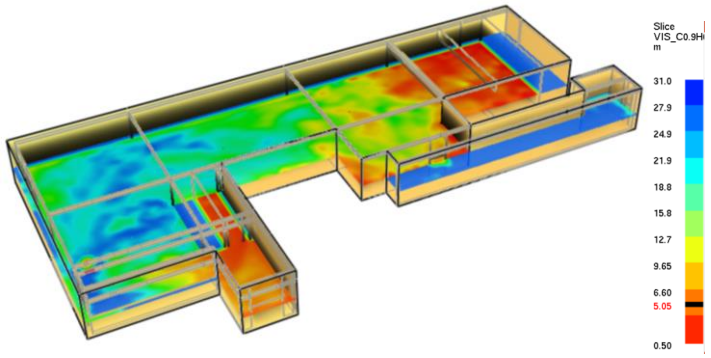

FIGURE 37. VISIBILITY AT 1.8 M ABOVE THE FLOOR AT RSET (269 SECONDS)

DESIGN FIRE SCENARIO 1 - CONCLUSION AND RECCOMENDATIONS

Egress from the first floor is adequate even with the loss of two sets of double-door exits from a theoretical ultra-fast fire. Loss of visibility is the key limitation for tenability. The first floor space has favorable features such as ceiling height and equally spaced exits which reduce the potential for scenarios trapping occupants in specific areas. The comparison of ASET and RSET is provided in Table 25. The pre-movement and movement times were determined in prior sections of this document.

The available safe egress time (ASET) was set at 400 seconds at which time visibility is lost in a majority of the cafeteria area and café. The required safe egress time (RSET) was determined to be 269 seconds based on the summation of alarm, detection, pre-movement, and movement times which corresponded with a loss of visibility in the food serving areas. This does not mean total visibility was lost, but visibility was lost at 1.8 meters above the floor. Visibility was still possible, but upright egress would be limited.

TABLE 25. DESIGN FIRE SCENARIO ONE – ASET VS. RSET

ASET						400 s
	RSET					269 s
Ignition	Detection Time	Alarm Time	**Evacuation Time**			**Safety Margin**
			Pre-movement Time		Movement	
			Recognition Time	Response Time		
Electrical	Visual	Manual	See smoke	Grab stuff	Travel Time	
t = 0 s	15 s	30 s	15 s	30 s	179 s	131 s.
	Sprinkler*	Waterflow				
	46 s	60 s				

*Alternate RSET path based on a fire at night with automatic detection.

The ASET vs. RSET Table 25 is an easy way to view the egress time in components. As discussed earlier, the assembly space is open and visibility is good throughout the area. The only interior walls are decorative and made of chains. So we estimate a short detection time, travel time to a manual pull station, a short recognition time due to seeing smoke and quickly collecting belongings. When the occupant load is high, the visual detection and response will be quick and the alarm will be a manual pull station. Which provides us with a benefit over automatic sprinkler activation of 46 seconds and then a 60 second alarm delay based on the FDS results and activation of the second sprinkler

There were limitations to this model. A lack of a detailed internal model with all architectural features. It is possible that ceiling features and chain link partitions could delay smoke travel to the cafeteria/kitchen or force it lower reducing visibility, but it is beyond the abilities of FDS to model membranes. The DETACT model was not used to determine the capping of the design fire heat release rate. The second sprinkler to operate in the preliminary simulations was used based on advice from the AHJ. It is assumed that if the model is designed properly, this is a more accurate representation of activation because it includes the effect of asymmetric spaces and building features. The capping of the heat release rate and resuming of the fire test heat release rate curve was an assumption, but determined to be more probable than maintaining the HRR for the tree.

The following recommendations are based on the FDS results:

- The reduction of visibility in the elevator lobby, security desk, and fire command center are a concern. These are the areas where the fire department will respond and the location of the fire command center. A potential solution is the installation of a smoke barrier triggered by a water flow alarm to isolate the front lobby.

- A general reduction of the amount combustibles in the ground floor common area and cafeteria with a potential limit on the heat release rates of objects in the area will reduce the potential for a significant event.
- The size of the entry door to the south corridor was reduced from the original plan, but did not have a dramatic effect in the fire scenario presented.

DESIGN FIRE SCENARIO TWO

PARITAL EVACUATION OF SOUTH TOWER

Total time to evacuate floors 9 thru 13 assuming fire is on the 12th floor and evacuation follows City of Phoenix requirements to evacuate the floor above the fire and two floors below. The typical upper floor layout is provided below in Figure 32 showing the split of occupant loading at the common area and location of fire on the floor below. Areas of refuge are identified.

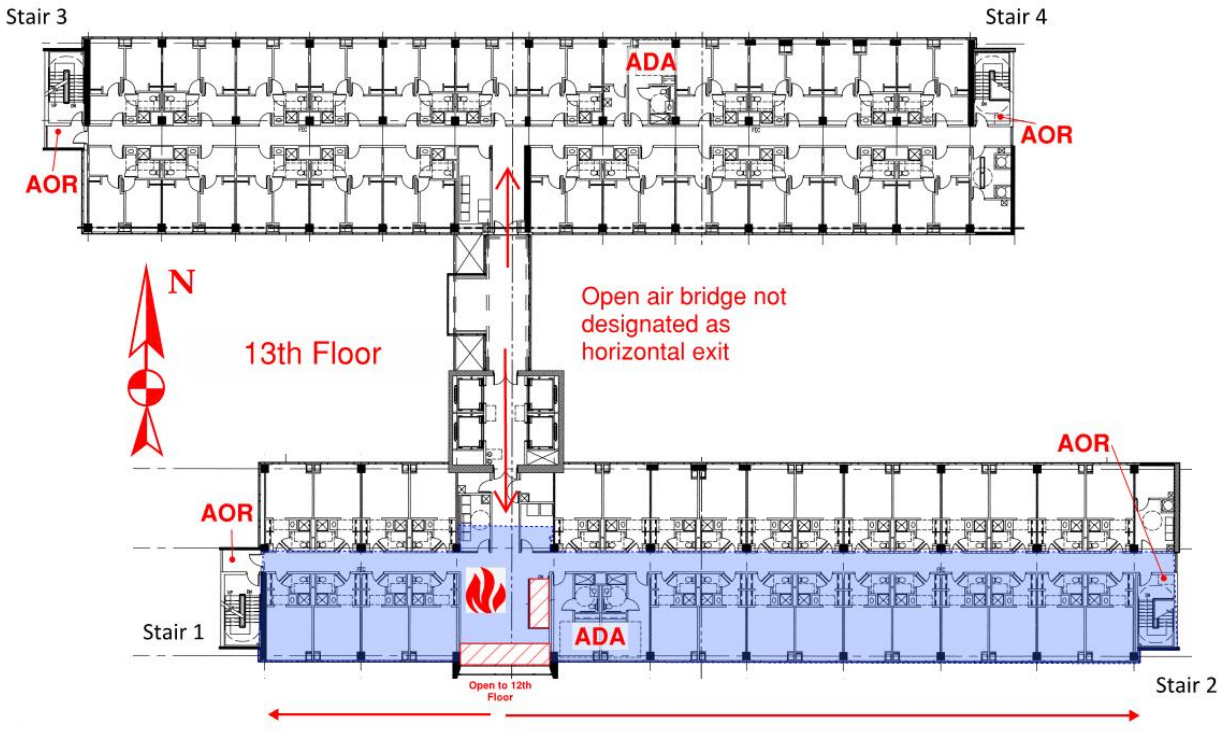

FIGURE 38. TYPICAL UPPER FLOOR PLAN VIEW SHOWING EGRESS AND FDS BOUNDARIES

When stair is filled, the egress time is restricted by the 36" stairway discharge door with a rate of discharge of 48.0 persons per minute. The assumed evacuation method is that the building is evacuated from the top down. This is based on the NFPA Handbook and example 4.6 that the building is evacuated from the top down. The merging flow from the exit door does not restrict the flow in the stairwell since it is still regulated by the maximum

specific flow of the door.

The fire scenario is a fire at night while most students are asleep and an electrical source ignites a small upholstered chair. Assume ignition occurs at time t=0, then sprinkler operates at 106 seconds (FDS 2nd sprinkler to operate), and a 60 second delay for waterflow alarm to activate building alarm. Based on the DETACT model, smoke detection should occur at 10 seconds with 60 seconds for security investigation and alarm as shown in Table 26. Pre-movement time is expected to be less than 2 minutes due to voice evacuation with trained staff per SPFE Handbook Table 4-2.1 based on high-rise office and apartment evacuation times.

It is a small building and egress paths are approximately 120 feet with 2-3 feet per second travel speed plus time to gather personal belongings is reasonable. After stair fills, remaining occupants exit at a rate of 48 occupants per minute. The limitations of this analysis is that it uses only the South Tower occupant load which is assumed larger than the North Tower occupant load which will exit at a slightly higher rate.

The required time to exit the 12th and 13th floor is calculated as follows:

(137 occup.)/(48.0 occup/min) = (2.85 min) = 171 seconds

2.85 min + 0.346 min = 3.20 min = 192 seconds to exit the floor

The required time to exit the 10th and 11th floor is calculated as follows:

(97 occup.)/(48.0 occup/min) = (2.02 min) = 121 seconds

2.02 min + 0.346 min = 2.37 min = 142 seconds to exit the floor

The estimated persons in the stair using travel time and egress capacity is:

(194 persons/floor) · (floor/2 stair) = 97 persons per stair

(0.346 minutes) · (48 persons/min) = 16.6 = 16 persons in one stair

(16 persons/floors) · (12 floors) = 192 persons in one stairwell.

Remaining 81 occupants on floor in que at the stair door at t=.346 minutes.

Table 26 provides a breakdown of egress by floor to calculate a total time to evacuate floors 9 thru 13 assuming fire is on the 12th floor. This calculation is not used in the ASET/RSET analysis, but provided to compare against the full tower evacuation of 28.3 minutes calculated earlier. We gain about 10 minutes of evacuation time with partial evacuation. Detection is based on smoke detection.

TABLE 26. EVACUATION OF FLOORS 10, 11, 12, AND 13 OF THE SOUTH TOWER

Actions	Time (s)	Rtotal (s)
Detection and alarm	70	70
Start Evacuation, pre-movement		120
Occup. fill stair	20.76	210.76
12th Occup. in Stair *FIRE*	191.76	402.52
12th floor stair empty *FIRE*	20.76	423.28
13th Occup. In Stair	171.76	595.04
13th floor stair empty	20.76	615.8
13th floor occup. / 12th stair	141.76	757.56
11th Occup. in Stair	20.76	778.32
11th floor stair empty	141.76	920.08
10th Occup. in Stair	20.76	940.84
10th floor stair empty		940.84
9th Occup. in Stair	20.76	961.6
9th floor stair empty		961.6
8th Occup. in Stair	20.76	982.36
8th floor stair empty		982.36
7th Occup. in Stair	20.76	1003.12
7th floor stair empty		1003.12
6th Occup. in Stair	20.76	1023.88
6th floor stair empty		1023.88
5th Occup. in Stair	20.76	1044.64
5th floor stair empty		1044.64
4th Occup. in Stair	20.76	1065.4
4th floor stair empty		1065.4
3rd Occup. in Stair	20.76	1086.16
3rd floor stair empty		1086.16
2nd Occup. in Stair	41.52	1127.68
Stair Empty		1127.68

Total time to evacuate floors 10 - 13 is 1127.7 seconds or 18.8 minutes.

FIRE DYNAMIC SIMULATOR (FDS) MODEL

The common area space on the twelfth and thirteenth floors were modeled in Pyrosim 2015, and could easily be exported to be analyzed in FDS 6.0. The model included the blue shaded spaces in Figure 38 above. The design fire is an upholstered chair fire from a paper on the heat release rates of furniture also referenced in the SFPE Handbook. The chair is designated as F21[2] in the literature was tested in accordance with California Technical Bulletin 117 indicating the components were tested to have some measure of fire resistance. A chair would be a typical piece of furniture found in this open conversational seating area. This design fire has been approved by the Authority Having Jurisdiction (AHJ).

Per Arizona State University design guides, furniture meeting either California Technical Bulletin 117 and/or 133 is accepTable. CA TB 117 was first issued in 1975 as a required test for filling materials and not the fabric coverings leading to the use of fire retardants in the filling materials. The test was conducted by using a small open flame on the bare filling materials. Over time researchers determined that the CA TB 117 was not a good test for predicting real world performance of furniture. Research also focused on the nature of the ignition sources were smoldering such as a lit cigarette that falls into the chair crease.

Introduced in 1991, California Technical Bulletin 133 was introduced as a heat release rate and fire growth test of a single piece of furniture in a burn room. The furniture had to meet specific criteria with respect to heat release, carbon monoxide, toxic byproducts, and temperature rise. This resulted in the use of inner layers of fire retardant materials to prevent and ignition source from penetrating past the outer layers of fabric. In 2013, the ignition source method of CA TB 117 was rescinded and a new test using a smoldering source of ignition, but it is still a component test.[3] The type of furniture used during the initial decorating of the Taylor Place is not known, but the time period is prior to the changes in CA TB 117. Furniture conforming to CA TB 133 is tested as an assembly and assumed to have a low heat release rate. The furniture used in the design fire is based on a NIST paper and the SFPE handbook known to meet CA TB 117. The F21 Chair will initially be considered as it is the most conservative course.

2 *Upholstered Furniture Heat Release Rates Measured with a Furniture Calorimeter*, Babrauskas, et. al., 1982
3 *White Paper on Upholstered Furniture Flammability*, NFPA, September 2013.

Figure 39 shows the heat release rate (HRR) curve with the upholstered chair generating a peak heat release rate of 2,000 kW in approximately 250 seconds. The chair is located near the corridor below the mezzanine which will effectively send smoke down the lower corridor and upper corridor thru the floor opening near the window as shown in Figure 40.

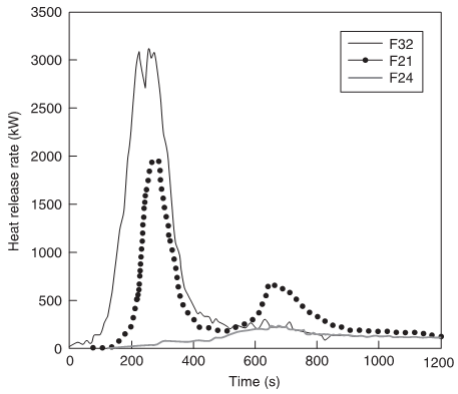

FIGURE 39. HEAT RELEASE RATE OF CHAIR F21 FROM SPFE HANDBOOK FIGURE 3-1.52

The FDS model consisted of 10 separate meshes to break up the model and allow for detailed modeling if necessary. This appeared beneficial when using Open MP environment option as each mesh was assigned to a thread. The grid sizing was initially course and then reduce to a moderate size of 0.15m^3 to improve the simulation, although increasing computational time from hours to days. The type of combustion was expected to be flaming from the flexible polyurethane cushions on the chair with a carbon monoxide yield of 0.042% and a soot yield of 0.198[4].

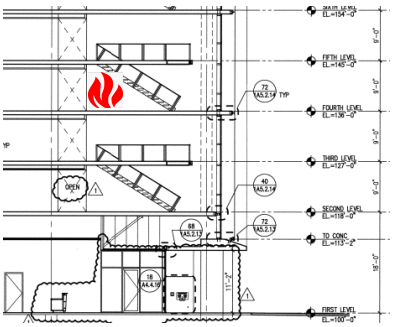

FIGURE 40. TYPICAL ELEVATION VIEW OF COMMON AREA WITH FIRE LOCATION

Interior features of the space shown in Figure 40 above were modeled were they appeared to have a direct impact on the flow of heat and smoke at the ceiling level. The space consists of a full lower floor and a partial mezzanine level with a convenience stair and

3. *SFPE Handbook 4th Edition, Table 3-4-16*

vertical opening between the floors. This common space is unique to the south tower. The common area unevenly splits the two floors with a majority of the occupant load on the east corridors. A corridor to the elevator lobby and a dorm room with open door are also included in the model for observations. Corridor doors are self-closing, so the door would have to be propped open.

FDS RESULTS

The FDS model results were analyzed based on the tenability criteria of visibility, carbon monoxide exposure, and temperature exposure. A general analysis of the behavior of the smoke was also made to predict its effect on occupants in the space. The results of the analysis were used to determine the values used in the ASET/RSET comparison.

Preliminary models were run and calculated the approximate activation of ceiling sprinklers in the model based on a 2MW chair fire. The sprinklers were modeled as heat detectors with the activation of the second sprinkler used as the start of suppression. Based on the model results, the second sprinkler activates at approximately 211 seconds. This appears due to the location of the fire and the airflow from the lower level pushing the plume toward the vertical opening as shown in Figure 40. Smoke detection will occur quickly, but require the security officer's investigation to initiate an alarm either visually or by camera.

The graph of the heat release rate is shown in Figure 41. In this model the heat release rate was capped at 211 seconds at the activation of the second sprinkler, and does not follow the HRR curve as shown in Figure 39. Capping and maintaining a 200kW heat release rate is possible with sprinkler protection controlling the fire.

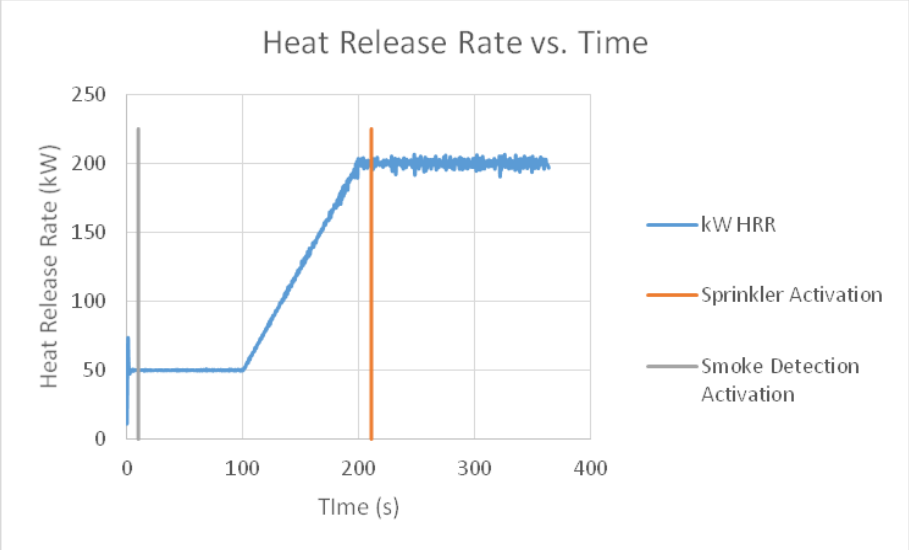

FIGURE 41. HEAT RELEASE RATE OF CHAIR F21 AFTER SPRINKLER ACTIVATION

When the model was created several slices were taken of the space and then viewed in Smokeview, a simulation viewing program. The results were interesting especially with the moderate cell size used. The fire location is shown as a red square in Figure 42 with the extents of the model in yellow.

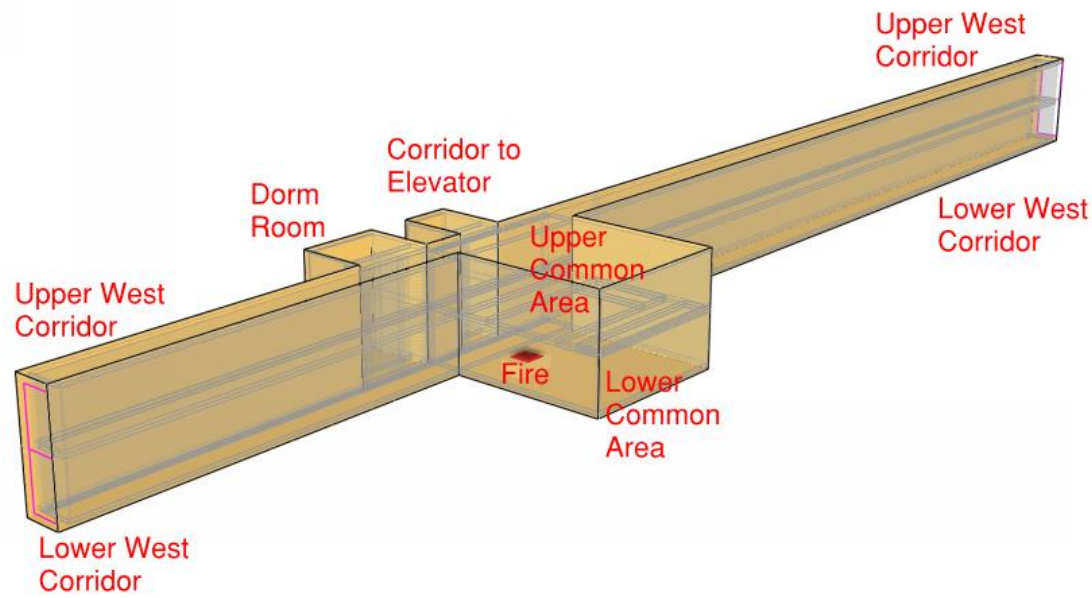

FIGURE 42. FDS MODEL RENDER

The results of the FDS model capping the fire at 250 kW shows tenability is not currently maintained based on visibility at 1.8 meters above the floor throughout the space. This is broken down into specific areas. The areas are shown in Figure 42, are lower west corridor, upper west corridor, lower common area, upper common area, upper east corridor, and lower east corridor. The criteria for visibility in these areas is 5 meters, and Table 27 summarizes the times for when visibility is totally lost in each area and egress time based on flow restriction through the stairway door. The goal is upright egress, so as the smoke reaches the end of the hall it banks down and rebounds back into the corridor.

Given the detection, alarm, and pre-movement times of 190 seconds with smoke detection the occupants will be entering the corridor with almost no visibility. The likelihood of the fire spreading past the common area is minimal due to tile flooring and fire resistant construction, so students could shelter in place. It is still highly likely many students will opt to escape thru the corridor.

TABLE 27. TOTAL LOSS OF VISIBILITY BY AREA

Area	Total Loss of Visibility
Lower common area	88 seconds
Lower west corridor	90 seconds
Upper common area	111 seconds
Upper west corridor	177 seconds
Lower east corridor	194 seconds
Upper east corridor	330 seconds

In Table 27 occupants are split based on the location in Figure 42 and the common area resulting in an unbalanced load. When the alarm and pre-movement time is added to the travel time from the floor, we have an untenable condition for students still in their rooms. Based on the DETACT spreadsheet calculation and security response we could expect an early alarm response from a smoke detector located on the ceiling. The activation should occur at 10 seconds and the security response should occur between 10 and 70 seconds - if security is able to view the location on the security cameras and trigger an alarm.

For the lower west corridor, tenability is limited by visibility at 5.0m which is lost at approx. 124 seconds after ignition as seen in Figure 43 and Figure 44 (next page). At this point the visibility drops below 5m which could lead to someone becoming disoriented.

FIGURE 43. 3D SMOKE VISIBILITY AT 190 SECONDS WITH 250KW CAPPED HEAT RELEASE RATE

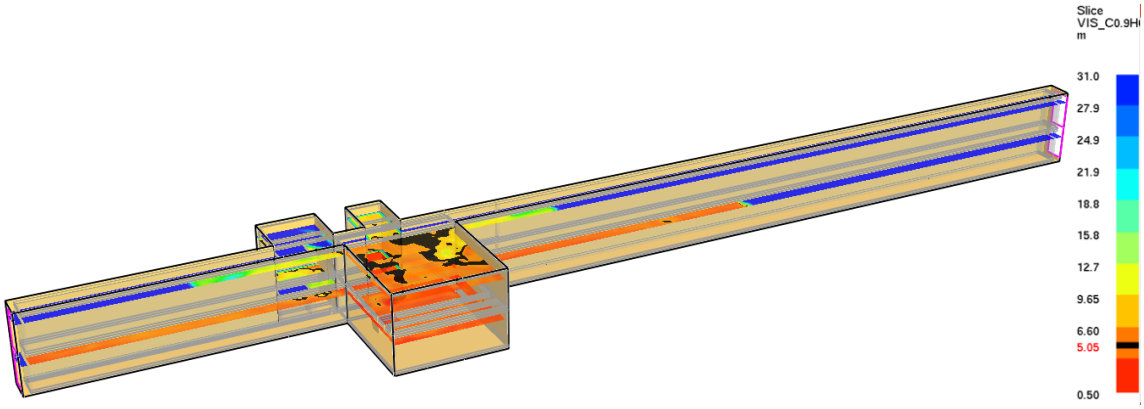

FIGURE 44. 5.0M VISIBILITY AT 1.8 M ABOVE THE FLOOR AT 124 SECONDS (2MW)

The smoke production in the area is too great to permit an adequate time to egress the corridors based on the F21 chair with California polyurethane foam and wood frame. This is largely due to the soot produced by the polyurethane at Ys (g/g) of 0.198 for the flexible polyurethane foam. The F21 fire test was conducted prior to the changes in California CA TB 117 using a California foam that is a heavy smoke producer due to chemicals and fire retardants. Since the construction of the building occurred prior to the changes in CA TB 117, it is assumed the furniture in the building meets this test. At the time of construction, the CA TB 117 test would have been initiated using a lit methenamine tablet.

Furniture constructed and tested using a test to represent the hazard from a smoldering ignition meeting the CA TB 133 test criteria is an option in the ASU Design Guide. This is a more realistic assembly test being a complete furniture assembly using an ignition source to simulate smoldering fires. A fire barrier integrated into the upholstery of the chair, a lit cigarette could ignite the fabric, but it should not penetrate the fire barrier into the polyurethane foam.

The FDS user guide states, by default FDS generates smoke in direct proportion to the heat release rate.[5] A soot yield rate of 0.198 is 0.198 of the fuel burning rate. To simulate a smoldering fire in FDS would require defining a smoke production rate independently of the HRR.

This leads to a change in the fire scenario using the criteria of A or B from the CA TB 133 test success criteria provided as follows:

> *A. Seating furniture fails to meet the requirements of this test procedure if any of the following criteria are exceeded in a room test using the room instrumentation.*

5 P. 169 Fire Dynamic Simulator User's Guide, NIST Special Publication 1019, Sixth Edition, November 26,2013.

1. A temperature increase of 200°F or greater at the ceiling thermocouple.
2. A temperature increase of 50°F or greater at the 4-foot thermocouple.
3. Greater than 75% opacity at the 4-foot smoke opacity monitor.
4. Carbon monoxide concentration in the room, as measured in accordance with Section VI, Part C, of 1000 ppm or greater for 5 minutes.
5. Weight loss due to combustion of 3 pounds or greater in the first 10 minutes of the test.

B. Seating furniture fails to meet the requirements of this test procedure if any of the following criteria are exceeded in a room test using oxygen consumption calorimetry.
1. A maximum rate of heat release of 80 kW or greater.
2. A total heat release of 25 MJ or greater in the first 10 minutes of the test.
3. Greater than 75% opacity at the 4-foot smoke opacity monitor.
4. Carbon monoxide concentration in the room, as measured in accordance with Section VI, Part C, of 1000 ppm or greater for 5 minutes.

The CA TB 133 test uses a small 10 inch by 10-inch burner shown in Figure 45 which is ignited and maintained for 80 (+/- 2) seconds. Combustion is allowed to continue until it ceases, 1.0 hour of testing has elapsed, or flame/flash over is inevitable.

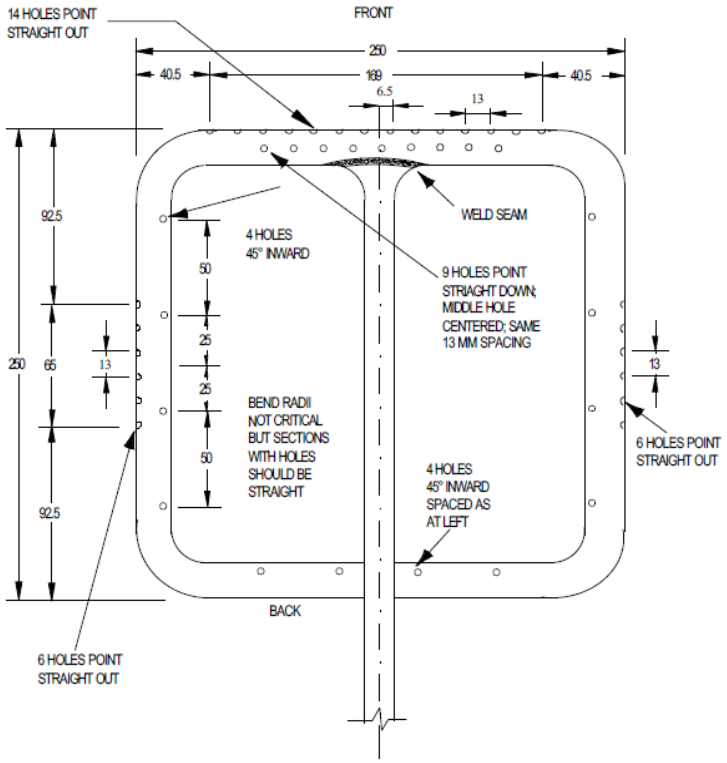

FIGURE 45. CALIFORNIA TECHNICAL BULLETIN GAS BURNER DESIGN

Using the success criteria from the CA TB 133 test, we will be able to meet our tenability requirements. The CA TB 133 test criteria is based on a 4-foot by 12-foot room in Figure 46. When this criterion is applied to the common areas, we would expect similar results due to the size of the common area in the South tower.

The tenability criteria for success in Taylor Place performance base validation is based on visibility, carbon monoxide, and temperature (hyperthermia). In the FDS simulation using a fire capped at 250kW at 211 seconds, we maintained tenability with carbon monoxide levels below 1,700ppm and temperatures below 70°C (158°F). At the lower heat release rate and restrictive criteria of CA TB 133, these levels are expected to be lower. Tenability primarily failed on visibility for the FDS model. Using the CA TB 133 test criteria, smoke opacity for the 10 x 12 x 8-foot-high room is 75% opacity at the 4-foot high smoke opacity monitor. We would also expect this volume of smoke to dissipate into the 25 x 25 x 16-foot-high. Using this criterion and the 10-minute limit on heat release rate, we will achieve tenability.

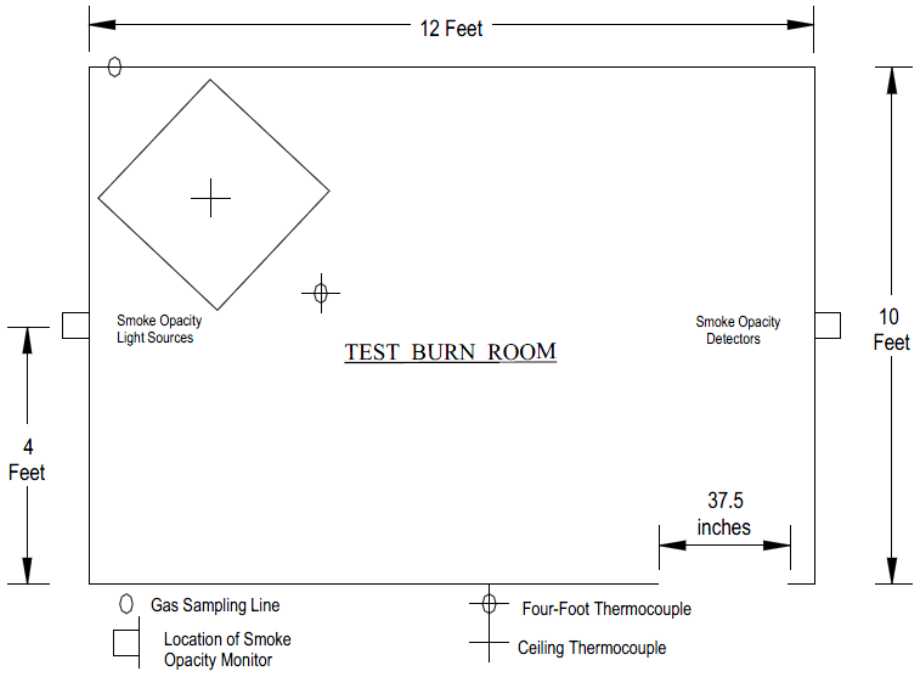

FIGURE 46. ROOM CONFIGURATION FOR TESTING ITEMS NO MORE THAN 40 INCHES ACROSS

An FDS model was developed to test these criteria using a new design fire using polyester representative of the upholstery of the chair and replicating the heat release rate provided in the CA TB 133 standard. The soot yield of polyester is 0.09 compared to polyurethane's soot yield of 0.198 is much lower. Trying to model a smoldering fire requires defining a smoke production rate independent of the HRR. But since the FDS

simulation is a graphical representation of a relationship between the smoke production and heat release rate, this is not severe limitation. The CA TB 133 criteria is sufficient to show tenability, so additional models were not simulated. In the event of a smoldering fire in the chair, a smoke detector would activate notifying security, who based on the location of the fire should be able to extinguish a smoldering or incipient fire with a portable extinguisher.

CONCLUSION AND RECCOMENDATIONS

Egress time is inadequate based on the initial polyurethane 2 MW and 250kW capped F21 chair design fire chosen for the scenario. The smoke production from the chair and high heat release, even with early detection from a smoke detector did not provide sufficient egress time to the occupants. Based on the analysis, students could be entering the corridor at its most dangerous when the visibility is near zero under this scenario.

The furniture specification needs to be amended to exclude furniture meeting CA TB 117 and require only non-combustible furniture and/or furniture meeting the requirements of CA TB 133 in the common area. These requirements should be posted in the space to ensure the information is retained and connected to the space in the event of occupancy or ownership changes.

The available safe egress time (ASET) was set at 600 seconds based on the total HRR over a ten-minute period from the CA TB 133 test criteria in Table 28. The initial (ASET) with the 2MW fire was set at 124 seconds based on loss of visibility in the lower west corridor closest to the fire.

TABLE 28. DESIGN FIRE SCENARIO TWO – ASET VS. RSET

<table>
<tr><td colspan="6">ASET</td><td>600 s</td></tr>
<tr><td></td><td colspan="5">RSET</td><td>W: 262 s
E: 361 s</td></tr>
<tr><td rowspan="3">Ignition</td><td rowspan="3">Detection Time</td><td rowspan="3">Alarm Time</td><td colspan="3">Evacuation Time</td><td rowspan="3">Safety Margin</td></tr>
<tr><td colspan="2">Pre-movement Time</td><td rowspan="2">Movement</td></tr>
<tr><td>Recognition Time</td><td>Response Time</td></tr>
<tr><td>Electrical</td><td>Sprinkler</td><td>Waterflow</td><td>Voice Evac</td><td>Dress/Property</td><td>Travel[2]</td><td></td></tr>
<tr><td>t = 0 s</td><td>10 s
(DETACT)</td><td>60 s
(Security)</td><td>30 s</td><td>90 s</td><td>W: 72 s
E: 171 s</td><td>W: 338 s
E: 239 s</td></tr>
<tr><td></td><td>211 s[1]
(FDS/2nd sprinkler)</td><td>60 s</td><td colspan="4"></td></tr>
</table>

1. Alternate RSET path based on automatic detection method.
2. W = West and E = East

The second sprinkler to operate in the preliminary simulations was used based on advice from the AHJ. The first sprinkler technically operated earlier but due to the airflow under the mezzanine the second sprinkler was slow to activate. It may be possible to add the equivalent of a lintel to slow the flow of air below the edge of the mezzanine and improve sprinkler performance. It is assumed the model is designed properly, this is a more accurate representation of activation because it includes the effect of asymmetric spaces and building features. The capping of the heat release rate is needed.

The following recommendations are based on the FDS results:

- The source of this design fire is a polyurethane foam chair which is a heavy producer of smoke and some fire retardants increase the amount of smoke produced. The ASU design guide allows furniture meeting CA TB 117 and/or CA TB 133, but there were significant changes recently in how the tests were performed. Specifying furniture based solely on CA TB 133 will provide furniture tested as a complete assembly yielding more realistic results than a component tests like CA TB 117.

- Low level exit signs were not required due to the R-2 occupancy classification (this is not a hotel) and the occupants should be familiar with the layout of the building. The building codes are minimum codes, but when visibility is lost quickly at the ceiling for a building population that could be impaired low level lighting may be potentially beneficial.

- Additional corridor controls may prevent the spread of smoke such as fire doors located between the corridor and the common area. The doors could release from magnetic door holders blocking the corridor. Another option is a similar magnetically held horizontal exit located in the corridor to effectively divide the population between exits. Due to the uneven building layout, it may inadvertently load on stair more than the other.

- The furniture specification needs to be amended to exclude furniture meeting CA TB 117 and require only non-combustible furniture and/or furniture meeting the requirements of CA TB 133 in the common area. These requirements should be posted in the space to ensure the information is retained and connected to the space in the event of occupancy or ownership changes.

13. COMMISIONING

The commissioning plan is intended to ensure the specified fire protection and life safety systems perform according to the intended design and owner's project requirements (OPR). Commissioning shall include documentation of the design intent and the activities involving construction, acceptance, and warranty phases of this project.

FIRE PROTECTING AND LIFE SAFETY COMMISIONING TEAM

The commissioning team is comprised of the owners, stakeholders, authority having jurisdiction, installing contractors, manufacturer's representatives, general contractors, facility managers, and third party test entities.

Not all parties have been defined as the project is still in the planning phase. The team will be listed in the when it is assembled. The team will need to meet the qualification recommendations in Chapter 4 of NFPA 3.

INTEGRATED TESTING FOR ALL FIRE LIFE SAFETY SYSTEMS DOCUMENTATION

When the fire alarm system is nearing completion, integrated testing is planned for the fire command center, fire alarm system, energy management systems (AHU shutdowns), and the emergency power system. The resulting documentation becomes a part of the owner's documentation.

Three copies of a document describing testing procedures of all active fire protection systems will be submitted to the City of Phoenix Building Department at least 90 days prior to final testing. These systems include the sprinkler system, standpipes, fire pump, fire alarm system, emergency generator, emergency lighting, smoke control, and security system interface with such systems.

OPERATION AND MAINTENANCE (O&M) DOCUMENTATION

Before the building is occupied, a copy of the Operations and Maintenance (O&M) manual is to be provided to the owners. The initial draft manual contains all available information pertaining to the buildings systems. The final draft will include detailed information on the building, equipment, manufacturers, and maintenance of the building.

The owner may review the manual for 30 days and comment before a final version is provided. Then the O&M manual is submitted to the AHJ for approval.

FIRE FIGHTER OPERATION OVERVIEW

A fire fighter operation manual is provided to the fire department during the final tour of the building prior to occupancy. The manual lists all fire safety features, systems, and supplies with their locations indicated on a building floor plan.

FIRE SAFETY AND MANAGEMENT PLANS

As part of the handover of the building to the owners, a general fire safety and management plan was provided as required by PFC section 404.2. This plan has been developed in cooperation with the owners to be maintained by the owners and revised on an annual basis at a minimum.

A copy of the fire safety plan is located in the Appendix M.

IDENTIFICATION OF THE REQUIREMENTS FOR MAINTAINING SYSTEM PERFORMANCE

All active fire protection systems and devices are required to be regularly tested in accordance with applicable codes and standards by qualified individuals acceptable to the Phoenix Fire Department. These systems include the sprinkler system, standpipes, fire pump, fire alarm system, emergency generator, emergency lighting, smoke control, and security system interface with such systems. Records of all maintenance and testing are to be retained on-site and presented to the City of Phoenix representatives upon request.

INTEGRATED TESTING

The project is currently in its construction phase and integrated testing has not begun at this phase of the project. Information included here is preliminary in nature and change as the project progresses.
Three copies of a document describing testing procedures of all active fire protection systems will be submitted to the City of Phoenix Building Department at least 90 days prior to final testing. These systems include the sprinkler system, standpipes, fire pump, fire alarm system, emergency generator, emergency lighting, smoke control, and security system interface with such systems.

CONCLUSION AND COMMENTS

The devices, systems and approaches outlined in this report work integrally to provide a level of life safety and property protection intended by the applicable codes. This level of protection is based on the interaction of both active and passive fire protection features. Active systems include fire suppression and detection systems, as well as secondary power, communications, and mechanical smoke management. Passive features include compartmentalization with fire resistive separation, Type I construction, exit systems, property line setbacks and flame spread limitations.

Nothing in this document is intended to imply non-code compliance nor alternate approaches for code compliance.

This report provides general fire protection guidelines and recommendations developed for Taylor Place. Working drawings and specifications will be coordinated to comply with the fire protection features outlined in this document.

Prepared by:

_____

Fire Protection Engineer Date
Reviewed by:

Owner's Representative:

_____

Arizona State University Date

APPENDICES

A. CITY OF PHOENIX – FIRE LIFE SAFETY REPORT CHECKLIST (NOT USED)
B. FIRE DYNAMIC SIMULATION (FDS) MODELING FILES
C. MODIFICATIONS AND APPEALS
D. OAC MEETING NOTES
E. STAIRWAY PRESSURIZATION CALCULATIONS
F. PERFORMANCE BASED DESIGN AND LIFE SAFETY SMALL SCALE DRAWINGS
G. FIRE ALARM PRODUCT DATA SHEETS
H. HYDRAULIC CALCULATIONS
I. FIRE SPRINKLER PRODUCT DATA SHEETS
J. INSPECTION, TESTING, AND MAINTENANCE OF FIRE SYSTEMS
K. FIRE ALARM BATTERY CALCS – NORTH AND SOUTH TOWER
L. CALIFORNIA TECHNICAL BULLETIN CA TB 133
M. FIRE SAFETY MANAGEMENT PLAN

APPENDIX A
FIRE LIFE SAFETY REPORT CHECKLIST

City of Phoenix
PLANNING & DEVELOPMENT DEPARTMENT

Fire and Life Safety Reports (FLSRs) Policy

Code/Sections:	2012 Phoenix Building Construction Code (PBCC) Section 107.2.1.1, 2012 IBC, 2012 IFC, 2012 NFPA 3, 2012 NFPA 92
TRT Approved:	August 19, 2013

Background and Policy Statement

Fire and Life Safety Reports (FLSRs) have been required by the city of Phoenix for a number of years now. And until now, the city had no specific criteria as to format and content of the report. As a result, a lack of consistency in reports submitted to the city has resulted in increased staff time to review, confusion regarding what life safety features and systems are required for a given facility, and ambiguity on system testing requirements prior to COFO and ongoing during the life of the facility.

To simplify FLSRs for everyone, starting with Phoenix adoption of the 2012 International Codes published by the International Code Council (ICC) effective July 1, 2013, the city of Phoenix, by policy as stated herein, mandates the use of all necessary portions of ***NFPA 3, Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems, 2012 Edition*** in the development of FLSRs required by the PBCC.

NFPA 3 shall be used to identify and explain all life safety and fire protection systems; existing, new, passive and active, and shall be used to identify team members and their respective roles in the design and installation of equipment and systems covered by **NFPA 3**.

The attached standard format titled **Fire and Life Safety Report Checklist** (the Checklist) is based on NFPA 3 and shall be used for creating each FLSR. All FLSRs must be sealed by an Arizona registrant.

Purpose

While the city has not formally adopted **NFPA 3,** it was chosen as the basis for FLSRs because it offers a comprehensive, nationally recognized standard format structured to fit the criteria required for FLSRs. Its use yields consistent and ongoing records for all life safety equipment and systems throughout the life of facilities located in Phoenix. Those who wish to use **NFPA 3** in its entirety are encouraged to do so. However, only the portions of the document needed to identify team members and their roles, and to document all life safety and fire protection systems as stated herein, are required to be used. The FLSR is a living document that shall be maintained by the owner and updated, at the owner's expense, as needed for city plan review and inspection purposes.

For more information or for a copy of this publication in an alternate format, contact Planning & Development at (602) 262-7811 voice / (602) 534-5500 TTY.

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Required Contents of FLSRs

Format:

FLSRs shall include all the applicable information and data found in the Checklist[1] attached. The Checklist contains 4 categories, each with numbered sections. FLSRs shall conform to this format; all categories and numbered sections shall appear in the FLSR. Sections that do not apply to a particular facility shall be designated "not applicable" or otherwise identified as not used at that particular facility.

Smoke Control:

Where smoke control is required, or otherwise used, as in smoke protected assembly seating, **NFPA 92 Standard for Smoke Control Systems, 2012 Edition**, shall be used. **Note:** the 2012 IBC and IFC[2] both reference *NFPA 92B-09 Smoke Management Systems in Malls, Atria and Large Spaces;* however, in the 2012 edition, NFPA incorporated NFPA 92A and 92B into a single standard titled "**NFPA 92 Standard for Smoke Control Systems, 2012 Edition."**

Retro-commissioning:

The **2012 edition of NFPA 3 is the inaugural edition of the Practice**, so all existing equipment and systems are to be included in FLSRs for remodels and additions to existing facilities. ***Retro-commissioning***[3] is required for existing equipment and systems intended to remain in operation at the facility. Proposed removal of equipment and systems from existing facilities shall also be documented in the FLSR.

Conflicts:

Where a conflict between **NFPA 3** and the city of Phoenix adopted codes may occur, other than those identified herein, contact your team leader. The city of Phoenix will make a final determination.

---

[1] **Fire and Life Safety Report Checklist**, developed by city of Phoenix Planning & Development Department staff, July 2013.

[2] 2012 International Building Code and 2012 International Fire Code, Chapters 35 and 80, respectively.

[3] Per NFPA 3, Section 3.3.3.8*, "Retro-commissioning is the process of commissioning existing fire protection and life safety systems that were not commissioned when originally installed." And, per NFPA A.3.3.3.8, "Retro-commissioning is a process that ensures that building systems perform interactively according to the design intent and/or to meet the owner's current operational needs. This is achieved by documenting the design intent where possible and the current operational needs, measuring the existing performance, and implementing necessary operational and/or system modifications, followed by actual verification of performance, verification of O&M documentation, and training of operating personnel."

City of Phoenix
PLANNING & DEVELOPMENT DEPARTMENT

Fire and Life Safety Reports (FLSRs) Checklist

Standard Format - based on NFPA 3 *Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems*, 2012 Edition.

	Basis of Design	
1.	Building Description	• Intended use and occupancy groups • Construction type(s) • Building height • Number of floors above/below grade • Area per floor (s.f.) • Total area (s.f.)
2.	Applicable Codes, Standards, Laws and Regulations	See current list of adopted codes and standards
3.	Design Responsibility	Project design professional in responsible charge
4.	Description of Fire Protection and Life Safety Systems	
5.	Design and Construction Methodology	• Demolition • Phased construction • Occupancy plan
6.	Special Consideration and Description	Example: • Historic Preservation • Greater than 420 ft. in height • Institutional occupancy • Essential facility structure (natural disaster shelter)
7.	Testing Criteria	• NFPA 25 Inspection Testing and Maintenance of Water Based Fire Protection Systems • NFPA 72 National Fire Alarm Code • National Electric Code • NFPA 92, 2012 Edition
8.	Equipment and Tools	• Door fan test equipment • Smoke control pressurization equipment
	Passive, Active Fire Protection and Life Safety Equipment and Systems	
9.	Infrastructure (supporting building fire protection and LS systems)	• Fire flow available (PFC Appendix B) • Fire main and hydrants (municipal, private) • Water tank • Electrical service serving the building (Transformer size and location/method of protection) • Other Utilities: Information tech., natural gas,etc.
10.	Site Access for Emergency Response	• Fire emergency access • Fire command center • Fire fighter's air system • Access controlled egress doors

For more information or for a copy of this publication in an alternate format, contact Planning & Development at (602) 262-7811 voice / (602) 534-5500 TTY.

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11.	Fixed Fire Suppression Systems	• Automatic fire suppression system • Standpipe system • Fire pump and fire pump room • Commercial cooking • Special systems (pre-action, water mist, etc.)
12.	Fire Alarm Systems	• Detection design • Notification requirements (ADA, special design) • Voice evacuation • Emergency alarms (H Occupancy)
13.	Emergency Communications Systems (ECS)	• Two-way communication • Emergency responder radio coverage • Fire command center
14.	Smoke Control and Management Systems	• Stair pressurization • Elevator hoistway pressurization • Atrium smoke exhaust system • Smoke compartmentation • Fire fighter's smoke control panel • Diagram and controls • System acceptance
15.	Systems Associated with Commercial Cooking	• Fire resistant hood dueling (Type I hood) • Suppression system (UL 300)
16.	Normal, Emergency and Standby Power Systems	• NEC 700 Emergency (10 second) • NEC 701 Standby (60 second) • NEC 702 Optional
17.	Explosion Prevention and Control Systems	• Type of hazard and method of protection
18.	Fire-resistant and Smoke-resistant Assemblies	• Method of protection (i.e. spray fire proofing, tested assemblies, etc.) • Fire and smoke dampers • Fire and smoke doors • Through penetration fire stops • Smoke vents (including elevator hoistway venting) • Smoke and fire rated assemblies
19.	Special Design	• Alternative methods and materials
20.	Elevator Systems	• Type of elevator system • Fire service access elevator • Occupant evacuation elevators • Ambulance stretcher designated • Fire fighter's emergency operation (Phase I and II)
21.	Means of Egress Systems and Components	• Number of exits and/or stairways • Exit access components (fire/smoke resistant corridors) • Horizontal exits • Elevators • Access to the public way or staging
22.	Access Control	• Access controlled egress doors
23.	Critical Processes and Systems	• Energy management systems (see integrated testing requirements) • Hazardous materials and processes (temperature control etc.) • Mechanical refrigeration machine room

24.	Hazardous Materials/Operations	• Type of material and physical state • Maximum allowable quantities • Control areas
	Commissioning	
25.	Fire Protecting and Life Safety Commissioning Team	• Owner • Commissioning authority • Installing contractor(s) • Manufacturers' representatives • Construction manager / general contractor • Facility manager / owner's technical support • Third party test entity • AHJ
26.	Documentation for Basis of Design	• To be provided prior to Certificate of Occupancy
27.	Equipment and Systems Installed as Required	• Special inspection / observation certificate • Manufacturer's installation instructions and specifications
28.	Integrated Testing for All Fire Life Safety Systems Documentation	• Fire command center • Fire alarm system • Energy management system • Emergency power system
29.	Delivery of Operation and Maintenance (O&M) Documentation	• Smoke control • Active systems (WON doors, smoke guard, magnetically hold open)
30.	Fire Fighter Operation Overview	
31.	Training of Facility Operating and Maintenance Staff	
32.	Identification of the Requirements for Maintaining System Performance	
33.	Third Party Testing and Special Inspections	
	Integrated Testing	
34.	Performance in Accordance with Applicable Codes and Standards	
35.	Compliance with Basis of Design	
36.	Sequence of Operation	
37.	Installation in Accordance with Manufacturer's Published Instructions	
38.	Accuracy of Diagrams of System Interconnection and Device Location	
39.	Third Party Testing and Special Inspections	

APPENDIX B
FDS 6 MODELING FILE
COMMON AREA 12TH/13TH FLOOR

```
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Generated by PyroSim - Version 2015.4.1214
Feb 24, 2016 11:04:11 PM

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&DEVC ID='THCP @ Lower Hall 2', QUANTITY='THERMOCOUPLE', XYZ=-
0.75,3.25,2.3/
&DEVC ID='THCP @ Lower Hall 3', QUANTITY='THERMOCOUPLE', XYZ=-
0.75,9.45,2.3/
&DEVC ID='THCP @ Upper Hall 1', QUANTITY='THERMOCOUPLE', XYZ=-
0.75,-1.25,4.9/
&DEVC ID='THCP @ Upper Hall 2', QUANTITY='THERMOCOUPLE', XYZ=-
0.75,3.25,4.8/
&DEVC ID='THCP @ Upper Hall 3', QUANTITY='THERMOCOUPLE', XYZ=-
0.75,7.75,4.8/
&DEVC ID='THCP @ Lower QUAD 1', QUANTITY='THERMOCOUPLE', XYZ=
1.625,1.5,2.3/
&DEVC ID='THCP @ Lower QUAD 2', QUANTITY='THERMOCOUPLE', XYZ=
1.625,4.625,2.3/
&DEVC ID='THCP @ Lower QUAD 3', QUANTITY='THERMOCOUPLE', XYZ=
4.625,4.625,2.3/
&DEVC ID='THCP @ Lower QUAD 4', QUANTITY='THERMOCOUPLE', XYZ=
4.625,1.5,2.3/
&DEVC ID='THCP @ Upper QUAD 1', QUANTITY='THERMOCOUPLE', XYZ=
1.875,1.875,4.9/
&DEVC ID='THCP @ Upper QUAD 2', QUANTITY='THERMOCOUPLE', XYZ=
1.875,5.625,4.9/
&DEVC ID='THCP @ Upper QUAD 3', QUANTITY='THERMOCOUPLE', XYZ=
5.625,5.625,4.9/
&DEVC ID='THCP @ Upper QUAD 4', QUANTITY='THERMOCOUPLE', XYZ=
5.625,1.875,4.9/
&MATL ID='CONCRETE',
      FYI='NBSIR 88-3752 - ATF NIST Multi-Floor Validation',
      SPECIFIC_HEAT=1.04,
      CONDUCTIVITY=1.8,
      DENSITY=2280.0/

&SURF ID='BURNER',
      FYI='3000 kW/m2',
      COLOR='RED',
      HRRPUA=2000.0,
      RAMP_Q='BURNER_RAMP_Q',
      PART_ID='Tracer',
      DT_INSERT=0.1/
&RAMP ID='BURNER_RAMP_Q', T=0.0, F=0.0/
&RAMP ID='BURNER_RAMP_Q', T=100.0, F=0.025/
&RAMP ID='BURNER_RAMP_Q', T=200.0, F=0.1/
&RAMP ID='BURNER_RAMP_Q', T=300.0, F=1.0/
&RAMP ID='BURNER_RAMP_Q', T=400.0, F=0.125/
&RAMP ID='BURNER_RAMP_Q', T=500.0, F=0.1/
&RAMP ID='BURNER_RAMP_Q', T=600.0, F=0.125/
&RAMP ID='BURNER_RAMP_Q', T=700.0, F=0.25/
&RAMP ID='BURNER_RAMP_Q', T=800.0, F=0.125/
&SURF ID='Wall - Concrete',
      BACKING='VOID',
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      MATL_ID(1,1)='CONCRETE',
      MATL_MASS_FRACTION(1,1)=1.0,
      THICKNESS(1)=0.1/

&OBST XB=1.5,2.5,1.0,3.0,0.0,0.6, SURF_ID='INERT'/ Couch
&OBST XB=0.0,7.5,0.0,0.1,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 1
&OBST XB=0.0,7.5,7.4,7.5,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 2
&OBST XB=7.4,7.5,0.0,7.5,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 3
&OBST XB=0.0,0.1,-19.65,0.0,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 4
&OBST XB=-1.5,-1.4,-19.65,56.4,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 5
&OBST XB=0.0,0.1,7.5,56.4,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 6
&OBST XB=-5.1,-1.5,4.3,4.4,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 7
&OBST XB=-5.1,-1.5,2.2,2.3,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 8
&OBST XB=-5.1,-1.5,0.0,0.1,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 9
&OBST XB=-5.1,-1.5,7.3,7.4,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 10
&OBST XB=-5.1,-1.5,11.15,11.25,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 11
&OBST XB=-5.1,-1.5,-3.75,-3.65,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 12
&OBST XB=-2.7,0.0,-19.65,-19.55,0.0,5.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 12
&OBST XB=-2.7,0.0,56.3,56.4,0.0,5.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 12
&OBST XB=0.0,7.5,0.0,7.5,5.0,5.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Upper Ceiling
&OBST XB=0.0,7.5,0.0,7.5,2.4,2.6, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Lower Ceiling
&OBST XB=0.0,7.5,0.0,7.5,0.0,0.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Floor
&OBST XB=-2.7,0.0,-19.65,56.4,0.0,0.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Lower Hall Floor
&OBST XB=-1.5,0.0,-19.65,56.4,2.3,2.6, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Upper Hall Floor
&OBST XB=-2.7,0.0,-19.65,56.4,4.9,5.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Upper Hall Ceiling
&OBST XB=-5.1,-1.5,-3.75,11.25,2.3,2.6, RGB=153.0,153.0,153.0,
```

```
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Backplane floor
&OBST XB=-5.1,-2.7,-3.75,11.25,5.0,5.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Backplane floor
&OBST XB=-5.1,-2.7,-3.75,11.25,0.0,0.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Backplane floor
&OBST XB=-5.0,-4.9,-3.75,11.25,0.0,5.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Backplane Wall
&OBST XB=-2.9,-1.5,-1.75,-1.65,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 12
&OBST XB=-2.9,-2.8,-3.65,-1.65,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, SURF_ID='Wall - Concrete'/ Wall 12

&HOLE XB=-1.5,-1.4,-1.5,-0.6,0.0,2.0, RGB=51.0,255.0,255.0/ Lower
Left Door
&HOLE XB=-1.5,-1.4,-1.5,-0.6,2.6,4.6, RGB=51.0,255.0,255.0/ Upper
Left Door
&HOLE XB=-1.5,-1.4,2.2,4.3,0.0,2.4, RGB=51.0,255.0,255.0/ Lower
Hall Opening
&HOLE XB=-1.5,-1.4,2.2,4.3,2.6,5.0, RGB=51.0,255.0,255.0/ Upper
Hall Opening
&HOLE XB=6.25,7.4,0.1,7.4,2.4,2.6, RGB=51.0,255.0,255.0/ Window
Opening
&HOLE XB=1.5,5.25,5.9,7.4,2.4,2.6, RGB=51.0,255.0,255.0/ Stair
Opening

&VENT SURF_ID='BURNER', XB=1.5,2.5,1.5,2.5,0.6,0.6,
TEXTURE_ORIGIN=1.5,1.5,0.6/ Burner vent
&VENT SURF_ID='OPEN', XB=-1.4,0.0,57.0,57.0,0.1,4.9/ Vent07
&VENT SURF_ID='OPEN', XB=-1.4,0.0,-20.1,-20.1,0.1,4.9/ Vent08

&SLCF QUANTITY='TEMPERATURE', VECTOR=.TRUE., PBX=-0.75/
&SLCF QUANTITY='TEMPERATURE', VECTOR=.TRUE., PBY=7.0/
&SLCF QUANTITY='U-VELOCITY', VECTOR=.TRUE., PBX=2.0/
&SLCF QUANTITY='TEMPERATURE', VECTOR=.TRUE., PBY=2.0/
&SLCF QUANTITY='VISIBILITY', VECTOR=.TRUE., PBZ=1.8/
&SLCF QUANTITY='VISIBILITY', VECTOR=.TRUE., PBZ=4.4/
&SLCF QUANTITY='TEMPERATURE', VECTOR=.TRUE., PBZ=1.8/
&SLCF QUANTITY='TEMPERATURE', VECTOR=.TRUE., PBZ=4.4/
&SLCF QUANTITY='VOLUME FRACTION', SPEC_ID='CARBON MONOXIDE',
VECTOR=.TRUE., PBZ=1.8/
&SLCF QUANTITY='VOLUME FRACTION', SPEC_ID='CARBON MONOXIDE',
VECTOR=.TRUE., PBZ=4.4/
&SLCF QUANTITY='VISIBILITY', VECTOR=.TRUE., PBX=-0.75/


&TAIL /
```

APPENDIX B
FDS 6 MODELING FILE
FIRST FLOOR

```
First_Floor_6_0_15.fds
Generated by PyroSim - Version 2015.4.1214
Feb 22, 2016 8:12:33 PM

&HEAD CHID='First_Floor_6_0_15'/
&TIME T_END=800.0/
&DUMP RENDER_FILE='First_Floor_6_0_15.ge1',
COLUMN_DUMP_LIMIT=.TRUE., DT_RESTART=300.0/

&MESH ID='Main Hall A', IJK=84,80,34, XB=-0.6,12.0,-
0.5,11.5,0.0,5.1/
&MESH ID='Main Hall B', IJK=84,114,34, XB=-
0.6,12.0,11.5,28.6,0.0,5.1/
&MESH ID='Main Hall C', IJK=84,80,34, XB=-
0.6,12.0,28.6,40.6,0.0,5.1/
&MESH ID='Main Hall D', IJK=84,82,34, XB=-
0.6,12.0,40.6,52.9,0.0,5.1/
&MESH ID='Assy and Access', IJK=76,80,34, XB=12.0,23.4,-
0.5,11.5,0.0,5.1/
&MESH ID='Bathroom and Corridor', IJK=36,80,34, XB=
12.0,17.4,28.6,40.6,0.0,5.1/
&MESH ID='Security and Access', IJK=62,34,34, XB=
19.5,28.8,11.5,16.6,0.0,5.1/
&MESH ID='Elev', IJK=25,10,17, XB=12.0,19.5,13.6,16.6,0.0,5.1/
&MESH ID='Egress Corridor', IJK=16,188,34, XB=
17.4,19.8,31.3,59.5,0.0,5.1/
&MESH ID='Corridor Elev Lobby', IJK=16,36,34, XB=
15.0,17.4,54.1,59.5,0.0,5.1/


&PART ID='Tracer',
      MASSLESS=.TRUE.,
      MONODISPERSE=.TRUE.,
      COLOR='BLACK',
      AGE=60.0/

&REAC ID='Douglas Fir',
      FYI='SFPE 3rd - Table 3-4.13 and 3-4.14',
      FUEL='REAC_FUEL',
      C=1.0,
      H=1.7,
      O=0.74,
      N=2.0E-4,
      CO_YIELD=0.004,
      SOOT_YIELD=0.015,
      RADIATIVE_FRACTION=0.35/

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&DEVC ID='THCP @ 1.5m', QUANTITY='THERMOCOUPLE', XYZ=
15.0,2.0,1.5/
&DEVC ID='THCP @ 1.8m', QUANTITY='THERMOCOUPLE', XYZ=
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15.0,2.0,1.8/
&DEVC ID='THCP @ 2.1m', QUANTITY='THERMOCOUPLE', XYZ=
15.0,2.0,2.1/
&DEVC ID='THCP @ 2.0m', QUANTITY='THERMOCOUPLE', XYZ=6.0,5.0,2.0/
&DEVC ID='THCP @ 2.0m01', QUANTITY='THERMOCOUPLE', XYZ=
6.0,19.0,2.0/
&DEVC ID='THCP @ 2.0m02', QUANTITY='THERMOCOUPLE', XYZ=
6.0,33.0,2.0/
&DEVC ID='THCP @ 2.0m03', QUANTITY='THERMOCOUPLE', XYZ=
6.0,47.0,2.0/
&DEVC ID='Detector01', QUANTITY='THERMOCOUPLE', XYZ=
18.75,1.6,3.9/
&DEVC ID='Detector02', QUANTITY='THERMOCOUPLE', XYZ=
15.75,1.6,3.9/
&DEVC ID='Detector03', QUANTITY='THERMOCOUPLE', XYZ=
12.75,1.66,3.9/
&DEVC ID='Detector04', QUANTITY='THERMOCOUPLE', XYZ=
18.75,4.2,3.9/
&DEVC ID='Detector05', QUANTITY='THERMOCOUPLE', XYZ=15.5,4.2,3.9/
&DEVC ID='Detector06', QUANTITY='THERMOCOUPLE', XYZ=
12.75,4.2,3.9/
&DEVC ID='Detector07', QUANTITY='THERMOCOUPLE', XYZ=
18.75,7.7,3.9/
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&DEVC ID='Detector09', QUANTITY='THERMOCOUPLE', XYZ=
12.75,7.7,3.9/
&DEVC ID='Detector10', QUANTITY='THERMOCOUPLE', XYZ=
18.75,10.7,4.7/
&DEVC ID='Detector11', QUANTITY='THERMOCOUPLE', XYZ=
15.75,10.7,4.7/
&DEVC ID='Detector12', QUANTITY='THERMOCOUPLE', XYZ=
12.75,10.7,4.7/
&MATL ID='CONCRETE',
      FYI='NBSIR 88-3752 - ATF NIST Multi-Floor Validation',
      SPECIFIC_HEAT=1.04,
      CONDUCTIVITY=1.8,
      DENSITY=2280.0/

&SURF ID='BURNER',
      FYI='3000 kW/m2',
      COLOR='RED',
      HRRPUA=3000.0,
      RAMP_Q='BURNER_RAMP_Q',
      PART_ID='Tracer',
      DT_INSERT=0.1/
&RAMP ID='BURNER_RAMP_Q', T=0.0, F=0.0/
&RAMP ID='BURNER_RAMP_Q', T=40.0, F=0.05/
&RAMP ID='BURNER_RAMP_Q', T=47.0, F=0.667/
&RAMP ID='BURNER_RAMP_Q', T=75.0, F=0.667/
&RAMP ID='BURNER_RAMP_Q', T=100.0, F=0.166/
&RAMP ID='BURNER_RAMP_Q', T=150.0, F=0.133/
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&RAMP ID='BURNER_RAMP_Q', T=200.0, F=0.0833/
&RAMP ID='BURNER_RAMP_Q', T=300.0, F=0.05/
&RAMP ID='BURNER_RAMP_Q', T=400.0, F=0.0333/
&SURF ID='Wall - Concrete',
      BACKING='VOID',
      MATL_ID(1,1)='CONCRETE',
      MATL_MASS_FRACTION(1,1)=1.0,
      THICKNESS(1)=0.1/

&OBST XB=14.5,15.5,1.5,2.5,0.0,0.6, RGB=204.0,204.0,204.0,
TRANSPARENCY=0.498039, SURF_ID='INERT'/ Christmas Tree
&OBST XB=0.0,23.0,0.0,0.1,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
E Wall
&OBST XB=0.0,0.1,0.0,50.0,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
N Wall
&OBST XB=0.0,0.1,50.0,56.0,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
N Wall
&OBST XB=0.0,2.7,55.9,56.0,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
NW Wall
&OBST XB=2.6,2.7,56.0,64.0,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
WNW Wall
&OBST XB=0.0,12.0,40.9,41.0,4.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
W Wall
&OBST XB=11.9,12.0,40.6,64.0,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
SW Wall
&OBST XB=11.9,17.4,40.5,40.6,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
B/C W Wall
&OBST XB=17.4,17.5,28.6,54.4,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
B/C S Wall
&OBST XB=11.9,19.5,28.6,28.7,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
B/C E Wall
&OBST XB=11.9,12.0,11.5,28.6,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S Wall
&OBST XB=11.9,19.7,16.0,16.0,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
E/P E Wall
&OBST XB=11.9,19.8,11.4,11.5,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
E/P W Wall
&OBST XB=19.7,19.8,11.4,16.5,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
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S/A N Wall
&OBST XB=12.0,28.5,16.4,16.5,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S/A W Wall
&OBST XB=28.4,28.5,11.5,16.5,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S/A S Wall
&OBST XB=22.9,28.5,11.5,11.6,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S/A E Wall
&OBST XB=22.9,23.0,0.0,11.5,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
SE Wall
&OBST XB=0.0,19.8,0.0,64.0,4.9,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Ceiling
&OBST XB=-15.0,28.8,-5.6,64.0,0.0,0.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Floor
&OBST XB=0.0,12.0,46.9,47.0,4.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
W Wall
&OBST XB=0.0,12.0,52.6,52.7,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
W Wall
&OBST XB=0.0,12.0,46.9,47.0,0.0,1.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
W Wall
&OBST XB=19.7,19.8,0.0,11.5,4.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
SE Wall
&OBST XB=19.8,28.8,0.0,16.5,4.0,4.1, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
Ceiling Cafe
&OBST XB=19.4,19.5,28.6,59.2,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
B/C S Wall
&OBST XB=15.3,19.5,59.1,59.2,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
B/C W Wall
&OBST XB=17.3,17.4,28.6,54.3,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
B/C S Wall
&OBST XB=15.3,15.4,54.3,59.2,0.0,5.0, RGB=153.0,153.0,153.0,
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B/C W Wall
&OBST XB=15.3,17.5,54.3,54.4,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
B/C W Wall
&OBST XB=11.9,19.8,13.5,13.6,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
E/P W Wall
```

```
&OBST XB=11.9,12.6,5.7,6.4,0.0,5.0, SURF_ID='INERT'/ Obstruction
&OBST XB=11.9,12.6,0.1,0.8,0.0,5.0, SURF_ID='INERT'/ Obstruction
&OBST XB=16.9,17.6,0.1,0.8,0.0,5.0, SURF_ID='INERT'/ Obstruction
&OBST XB=16.9,17.6,5.7,6.4,0.0,5.0, SURF_ID='INERT'/ Obstruction
&OBST XB=19.0,19.7,4.2,4.9,0.0,5.0, SURF_ID='INERT'/ Obstruction
&OBST XB=11.9,12.1,7.0,8.4,0.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S/A N Wall
&OBST XB=11.9,17.6,0.0,2.2,4.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S/A N Wall
&OBST XB=11.9,17.6,3.5,4.9,4.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S/A N Wall
&OBST XB=11.9,17.6,7.0,8.4,4.0,5.0, RGB=153.0,153.0,153.0,
TRANSPARENCY=0.247059, OUTLINE=.TRUE., SURF_ID='Wall - Concrete'/
S/A N Wall

&HOLE XB=4.0,6.0,0.0,0.1,0.0,2.4, COLOR='CYAN'/ Door 3
&HOLE XB=6.5,8.5,0.0,0.1,0.0,2.4, COLOR='CYAN'/ Door 4
&HOLE XB=20.0,22.0,0.0,0.1,0.0,2.4, COLOR='CYAN'/ Door 5
&HOLE XB=28.4,28.5,12.5,15.5,0.0,2.4, COLOR='CYAN'/ Door 6
&HOLE XB=2.6,2.7,58.0,60.0,0.0,2.4, COLOR='CYAN'/ Door 7
&HOLE XB=19.7,19.8,14.0,15.5,0.0,4.1, COLOR='CYAN'/ Door 8
&HOLE XB=17.3,17.5,36.0,38.0,0.0,2.4, COLOR='CYAN'/ Door 9
&HOLE XB=18.0,19.0,59.1,59.2,0.0,2.4, COLOR='CYAN'/ Door 7

&VENT SURF_ID='BURNER', XB=14.5,15.5,1.5,2.5,0.6,0.6,
COLOR='RED', TEXTURE_ORIGIN=14.5,1.5,0.6/ Burner vent

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1.8/
&SLCF QUANTITY='VISIBILITY', VECTOR=.TRUE., PBZ=1.8/


&TAIL /
```

APPENDIX C
MODIFICATIONS AND APPEALS

RESERVED

APPENDIX D
OAC MEETING NOTES

RESERVED

APPENDIX E
STAIRWAY PRESSURIZATION CALCULATIONS

Summer Temperatures

Location	Walls (ft)		Wall Area(ft^2)	Leakage Rate	Leakage Area(ft^2)	Floors	Door leakage (ft^2)	Doors	Total Area(ft^2)
Asb2,13	18.7	9	168.0003	1.10E-04	1.85E-02	11	0.24	11	2.84
Asb2,13	11.3	9	101.25	1.10E-04	1.11E-02	11	0.24	0	0.12
Aso2,13	18.7	9	168.0003	3.50E-04	5.88E-02	11	0.24	11	3.29
Aso2,13	11.3	9	101.25	3.50E-04	3.54E-02	11	0.24	0	0.39
Asb1	18.7	18	336.0006	1.10E-04	3.70E-02	11	0.24	1	0.65
Asb1	11.3	18	202.5	1.10E-04	2.23E-02	11	0.24	0	0.25
Aso1	18.7	18	336.0006	3.50E-04	1.18E-01	11	0.24	1	1.53
Aso1	11.3	18	202.5	3.50E-04	7.09E-02	11	0.24	0	0.78

A_{SB}		3.86	(ft^2)	
A_{SO}		5.99	(ft^2)	
Ft	7.08*(1/To-1/Ts)	-0.0001	inH2O	Eq. 10.1
Ts	To+n(Tb-To)	564.77	R	Eq. 10.5
To	570.2		R	Winter
Tb	534		R	
n	0.15		heat transfer coeff.	
Fr	$1+A^2_{SB}T_B/A^2_{BO}T_S$	1.3921		Eq. 10.6
Fr	$1+A^2_{SB}/A^2_{BO}$	1.4147		Ex. 10.4
ΔP_{SBt}	$\Delta P_{SBb} = \Delta P_{SBt} - H*F_T / F_R$	0.1106	inH2O	
ΔP_{SBb}		0.1000	inH2O	Summer
ΔP_{SBav}	$\Delta P_{SBav} = (\Delta P_{SBt} + \Delta P_{SBb})/2$	0.1053	inH2O	Eq. 10.11
ΔP_{SOb}	$\Delta P_{Sob} = F_R \Delta P_{SBb}$	0.1415		
ΔP_{SOt}	$\Delta P_{Sot} = F_R \Delta P_{SBt}$	0.1565		
ΔP_{SOav}	$\Delta P_{SOav} = (\Delta P_{SBt} + \Delta P_{SBb})/2$	0.1490	inH2O	Eq. 10.11
m_{SB}	$m_{SB}=4.99*C*A_{SB}*\sqrt{(\Delta P_{SBav})}$	4.0603	lb/s	Eq. 10.13
	C	0.65	Coeff.	
m_{SOu}	$m_{SOu}=4.99*C*A_{SB}*\sqrt{(\Delta P_{SOu})}$	7.3074	lb/s	
	C	0.65	Coeff.	
m_{SOD}	$m_{SOD}=4.99*C*A_D*\sqrt{(\Delta P_{SOD})}$	0.2928	lb/s	
	C	0.65	Coeff.	
m_{SOR}	$m_{SOR}=4.99*C*A_{SB}*\sqrt{(\Delta P_{SOR})}$	0.0770	lb/s	
	C	0.65	Coeff.	
m_T	$m_{SB+}m_{SOu+}m_{SOD+}m_{SOR}$	11.737	lb/s	Eq. 10.13
ρ_O	$\rho_O = 144*p_{atm} / R*T_O$	0.06685	lb/ft^3	Eq. 10.21
	p_{atm}	14.12	lb/in^2	
V_T	$V_T = 60 * m_T / \rho_O$	**10,534.37**	**ft^3/min**	Eq. 10.22

Winter Temperatures

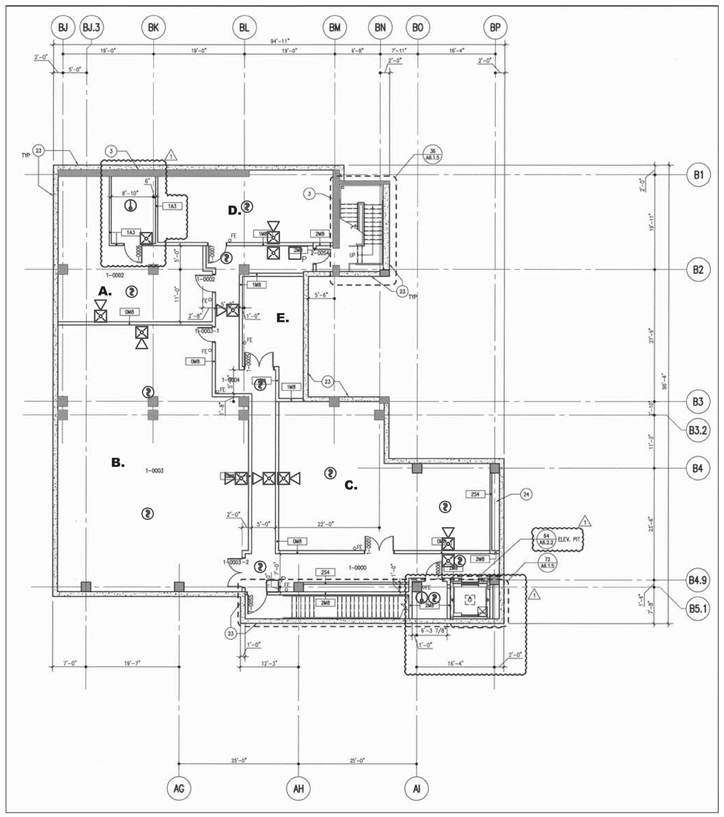
	Walls (ft)		Wall Area(ft^2)	Leakage Rate	Leakage Area(ft^2)	Floors	Door leakage (ft^2)	Doors	Total Area(ft^2)
Asb2,13	18.7	9	168.0003	1.10E-04	1.85E-02	11	0.24	11	2.84
Asb2,13	11.3	9	101.25	1.10E-04	1.11E-02	11	0.24	0	0.12
Aso2,13	18.7	9	168.0003	3.50E-04	5.88E-02	11	0.24	11	3.29
Aso2,13	11.3	9	101.25	3.50E-04	3.54E-02	11	0.24	0	0.39
Asb1	18.7	18	336.0006	1.10E-04	3.70E-02	11	0.24	1	0.65
Asb1	11.3	18	202.5	1.10E-04	2.23E-02	11	0.24	0	0.25
Aso1	18.7	18	336.0006	3.50E-04	1.18E-01	11	0.24	1	1.53
Aso1	11.3	18	202.5	3.50E-04	7.09E-02	11	0.24	0	0.78

A_{SB}	3.86	(ft^2)
A_{SO}	5.99	(ft^2)

Ft	7.08*(1/To-1/Ts)	0.0001	inH2O	Eq. 10.1
Ts	To+n(Tb-To)	503.91	R	Eq. 10.5
To	498.6		R	Winter
Tb	534		R	
n	0.15		heat transfer coeff.	
Fr	$1+A^2_{SB}T_B/A^2_{BO}T_S$	1.4395		Eq. 10.6
Fr	$1+A^2_{SB}/A^2_{BO}$	1.4147		Ex. 10.4
ΔP_{SBt}	$\Delta P_{SBt} = \Delta P_{SBb} + H*F_T / F_R$	0.1133	inH2O	
ΔP_{SBb}		0.1000	inH2O	Winter
ΔP_{SBav}	$\Delta P_{SBav} = (\Delta P_{SBt} + \Delta P_{SBb})/2$	0.1067	inH2O	
ΔP_{SOb}	$\Delta P_{Sob} = F_R \Delta P_{SBb}$	0.1415		
ΔP_{SOt}	$\Delta P_{Sot} = F_R \Delta P_{SBt}$	0.1603		
ΔP_{SOav}	$\Delta P_{SOav} = (\Delta P_{SBt} + \Delta P_{SBb})/2$	0.1509	inH2O	
m_{SB}	$m_{SB}=4.99*C*A_{SB}*\sqrt{(\Delta P_{SBav})}$	4.0861	lb/s	
	C	0.65	Coeff.	
m_{SOu}	$m_{SOu}=4.99*C*A_{SB}*\sqrt{(\Delta P_{SOu})}$	7.3074	lb/s	
	C	0.65	Coeff.	
m_{SOD}	$m_{SOD}=4.99*C*A_D*\sqrt{(\Delta P_{SOD})}$	0.2928	lb/s	
	C	0.65	Coeff.	
m_{SOR}	$m_{SOR}=4.99*C*A_{SB}*\sqrt{(\Delta P_{SOR})}$	0.0779	lb/s	
	C	0.65	Coeff.	
m_T	$m_{SB+}m_{SOu+}m_{SOD+}m_{SOR}$	11.764	lb/s	
ρ_O	$\rho_O = 144*p_{atm} / R*T_O$	0.07645	lb/ft^3	
	p_{atm}	14.12	lb/in^2	
Q	$Q = 60 * m_T / \rho_O$	**9,232.62**	**ft^3/min**	

APPENDIX F
PERFORMANCE BASED DESIGN AND LIFE SAFETY SMALL SCALE DRAWINGS

NOTES:
1. SEE SHEET FA.501 FOR FIRE ALARM NOTES AND DETAILS.
2. DEMOLISH HEAT DETECTORS WHEN AREA IS SPRINKLERED (TYPICAL TO ALL).



PLAN NORTH

1 FA101 BASEMENT FLOOR PLAN - FIRE ALARM

SCALE: 1/8" = 1'-0"

GRAPHIC SCALE

8 0 8 16

SCALE: 1/8" = 1'-0"

LEGEND - FIRE ALARM

- MANUAL PULL STATION
- FIRE ALARM STROBE (WALL-MOUNTED)
- FIRE ALARM STROBE (CEILING-MOUNTED)
- FIRE ALARM SPEAKER/STROBE (WALL-MOUNTED)
- FIRE ALARM SPEAKER/STROBE (CEILING-MOUNTED)
- FIRE ALARM SPEAKER (CEILING-MOUNTED)
- FIRE ALARM SPEAKER (WALL-MOUNTED)
- COMBINATION RATE-OF-RISE / FIXED TEMPERATURE HEAT DETECTOR
- BEAM SMOKE DETECTOR - TRANSMITTER / RECEIVER
- PHOTOELECTRIC SMOKE DETECTOR
- FACP - FIRE ALARM CONTROL PANEL
- MM - MONITOR MODULE
- R - RELAY MODULE
- Z - RELAY MODULE
- SS - SURGE SUPPRESSION
- TVSS - TRANSIENT VOLTAGE SURGE SUPPRESSION
- DACT - DIGITAL ALARM COMMUNICATOR TRANSMITTER
- FSA - REMOTE ANNUNCIATION PANEL WITH MICROPHONE
- EOL - END OF LINE RESISTOR
- VALVE TAMPER SWITCH
- WATERFLOW SWITCH
- XX - INDICATES CANDELA RATING
- EX - EXISTING DEVICE

Certification

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly licensed Architect under the laws of the State of Arizona.

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Arizona State University

CIVIL ENGINEER

FIRE / LIFE SAFETY CONSULTANT

STRUCTURAL ENGINEER

MEP ENGINEER

Project For

TAYLOR PLACE DORMITORY

Project No. 2085.003.02
Drawn By HJM
Checked By CST
Date 2/12/16

Revisions

No.	Date	Description

BASEMENT FLOOR PLAN
FIRE ALARM

FA.A2-00

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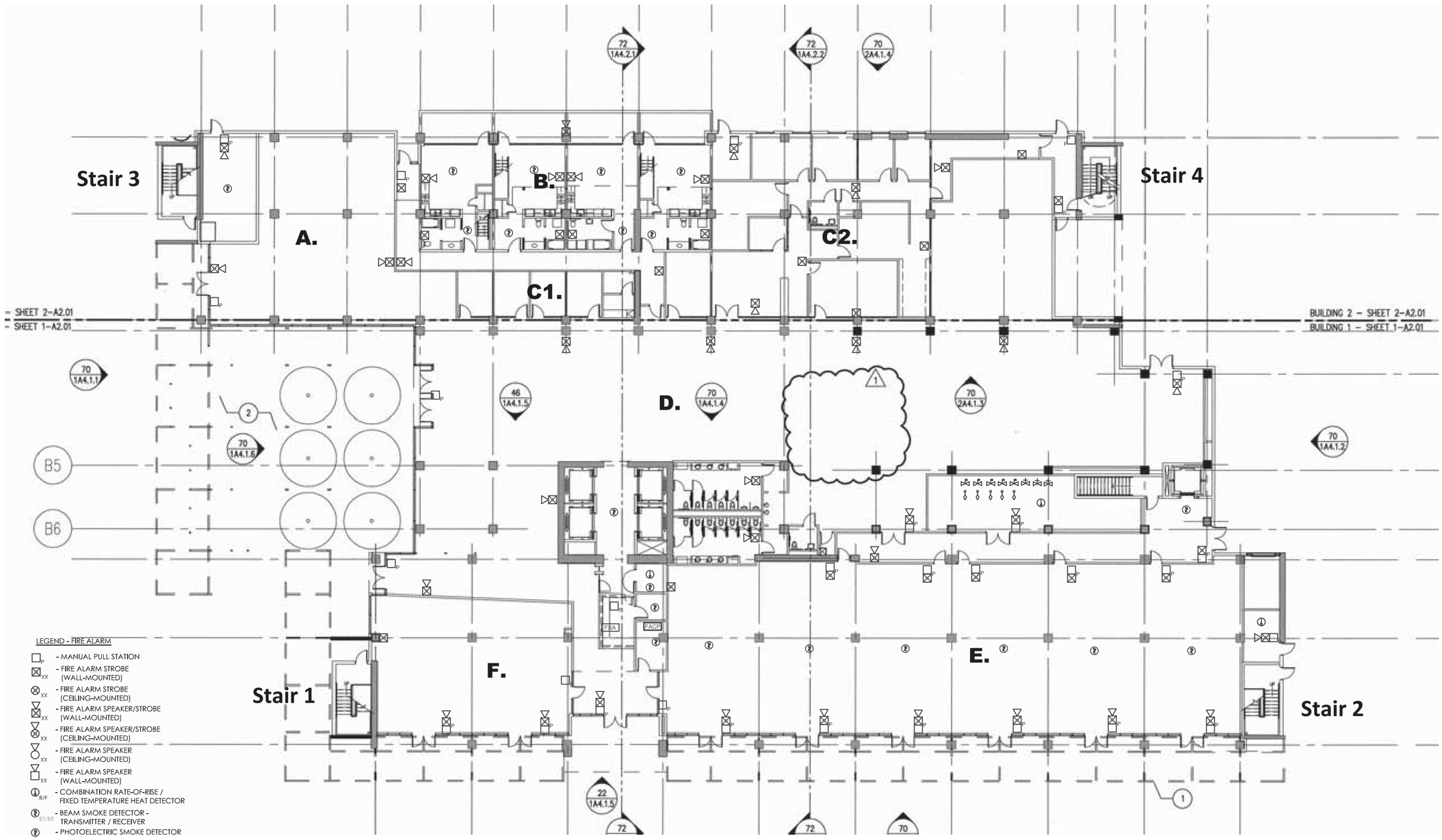
NOTES:
1. SEE SHEET FA501 FOR FIRE ALARM NOTES AN DETAILS.
2. ALL MANUAL PULL STATIONS SHOWN ARE EXISTING UNLESS OTHERWISE NOTED.
3. REDUCE CANDELA SETTING TO 15CD.



LEGEND - FIRE ALARM

- P - MANUAL PULL STATION
- XX - FIRE ALARM STROBE (WALL-MOUNTED)
- XX - FIRE ALARM STROBE (CEILING-MOUNTED)
- XX - FIRE ALARM SPEAKER/STROBE (WALL-MOUNTED)
- XX - FIRE ALARM SPEAKER/STROBE (CEILING-MOUNTED)
- XX - FIRE ALARM SPEAKER (CEILING-MOUNTED)
- XX - FIRE ALARM SPEAKER (WALL-MOUNTED)
- R/F - COMBINATION RATE-OF-RISE / FIXED TEMPERATURE HEAT DETECTOR
- BT/BR - BEAM SMOKE DETECTOR - TRANSMITTER / RECEIVER
- PHOTOELECTRIC SMOKE DETECTOR
- FACP - FIRE ALARM CONTROL PANEL
- MM - MONITOR MODULE
- R - RELAY MODULE
- Z - RELAY MODULE
- SS - SURGE SUPPRESSION
- TVSS - TRANSIENT VOLTAGE SURGE SUPPRESSION
- DACT - DIGITAL ALARM COMMUNICATOR TRANSMITTER
- FSA - REMOTE ANNUNCIATION PANEL WITH MICROPHONE
- EOL - END OF LINE RESISTOR
- VALVE TAMPER SWITCH
- WATERFLOW SWITCH
- XX - INDICATES CANDELA RATING
- EX - EXISTING DEVICE

PLAN NORTH

1 FA102 FIRST FLOOR PLAN - FIRE ALARM
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE
8 0 8 16
SCALE: 1/8" = 1'-0"

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Date	2/12/16

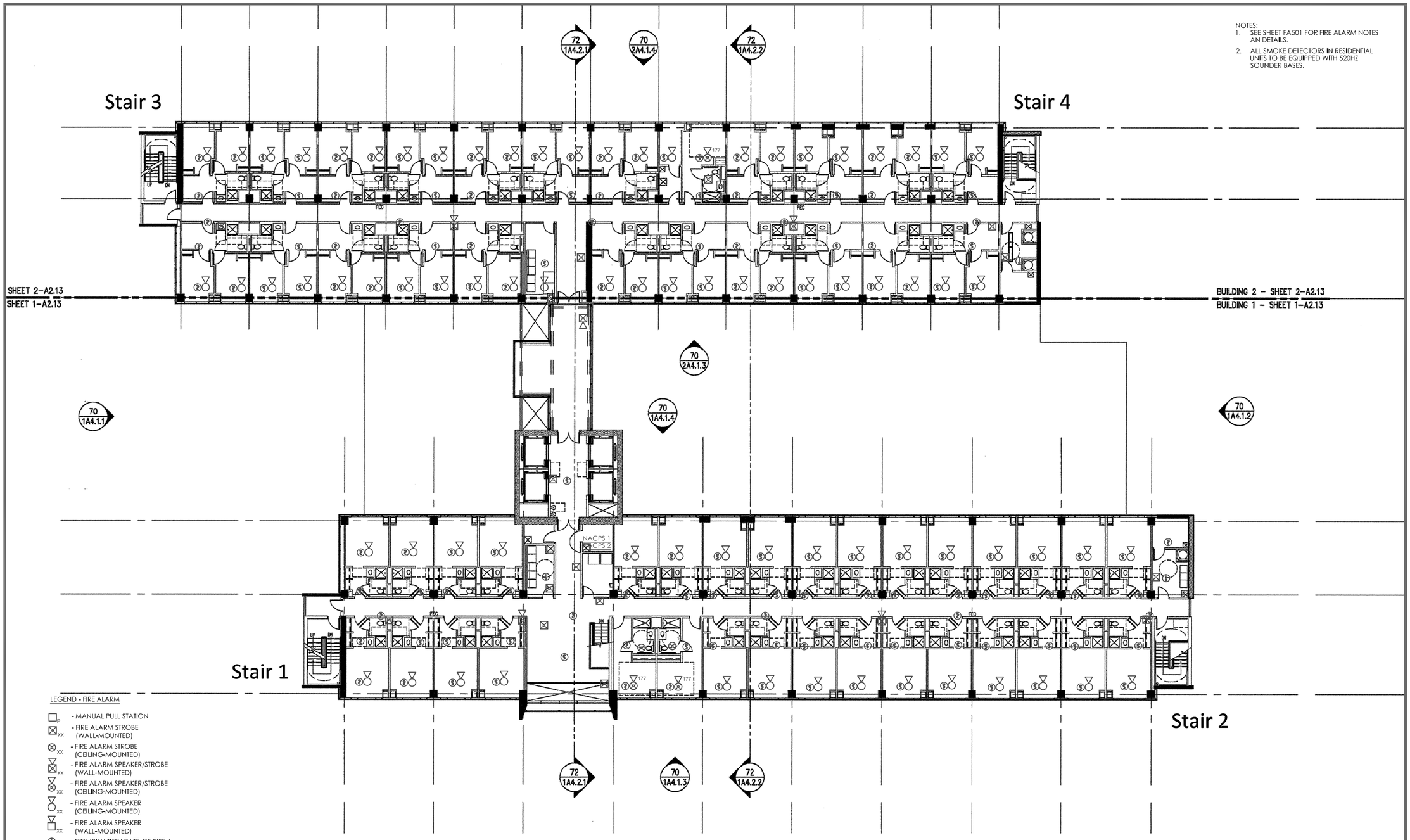
Revisions

No.	Date	Description

FIRST FLOOR PLAN FIRE ALARM

FA.A2-01

NOTES:
1. SEE SHEET FA501 FOR FIRE ALARM NOTES AN DETAILS.
2. ALL SMOKE DETECTORS IN RESIDENTIAL UNITS TO BE EQUIPPED WITH 520HZ SOUNDER BASES.



LEGEND - FIRE ALARM

- $\square_{P}$ - MANUAL PULL STATION
- $\boxtimes_{XX}$ - FIRE ALARM STROBE (WALL-MOUNTED)
- $\otimes_{XX}$ - FIRE ALARM STROBE (CEILING-MOUNTED)
- $\boxtimes_{XX}$ - FIRE ALARM SPEAKER/STROBE (WALL-MOUNTED)
- $\otimes_{XX}$ - FIRE ALARM SPEAKER/STROBE (CEILING-MOUNTED)
- $\bigcirc_{XX}$ - FIRE ALARM SPEAKER (CEILING-MOUNTED)
- $\square_{XX}$ - FIRE ALARM SPEAKER (WALL-MOUNTED)
- $\textcircled{I}_{R/F}$ - COMBINATION RATE-OF-RISE / FIXED TEMPERATURE HEAT DETECTOR
- $\textcircled{?}_{BT/BR}$ - BEAM SMOKE DETECTOR - TRANSMITTER / RECEIVER
- (?) - PHOTOELECTRIC SMOKE DETECTOR
- FACP - FIRE ALARM CONTROL PANEL
- MM - MONITOR MODULE
- R - RELAY MODULE
- Z - RELAY MODULE
- SS - SURGE SUPPRESSION
- TVSS - TRANSIENT VOLTAGE SURGE SUPPRESSION
- DACT - DIGITAL ALARM COMMUNICATOR TRANSMITTER
- FSA - REMOTE ANNUNCIATION PANEL WITH MICROPHONE
- EOL - END OF LINE RESISTOR
- VALVE TAMPER SWITCH
- WATERFLOW SWITCH
- XX - INDICATES CANDELA RATING
- EX - EXISTING DEVICE

PLAN NORTH

1 FA102 THIRTEENTH FLOOR PLAN - FIRE ALARM

SCALE: 1/8" = 1'-0"

GRAPHIC SCALE
8 0 8 16
SCALE: 1/8" = 1'-0"

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No.	Date	Description

THIRTEENTH FLOOR PLAN FIRE ALARM

FA.A2–13

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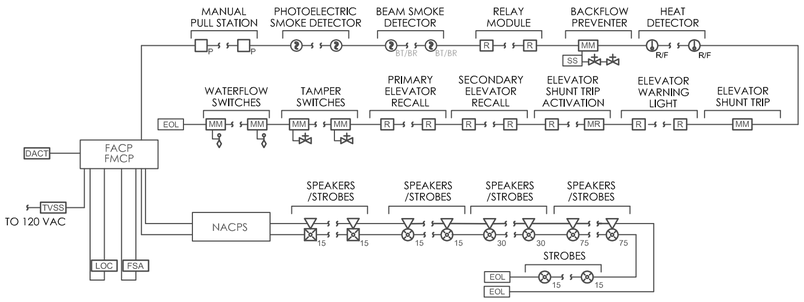
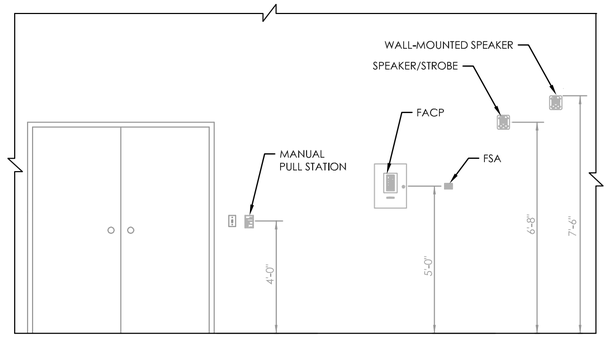
FIRE ALARM SYSTEM SEQUENCE OF OPERATION MATRIX															
	ALARM AT FACP & FSA	SUPERVISORY AT FACP & FSA	TROUBLE AT FACP & FSA	ALARM AT RECEIVING STATION	SUPERVISORY AT RECEIVING STATION	TROUBLE AT RECEIVING STATION	ACTIVATE SPEAKERS & STROBES	SILENCE SPEAKERS STROBES	SHUTDOWN AHU	PRIMARY ELEVATOR RECALL	SECONDARY ELEVATOR RECALL	ELEVATOR SHUNT TRIP	ACTIVATE FIRE FIGHTER HAT	SHUTDOWN AHU/ERV	OVERRIDE FA MESSAGE
MANUAL PULL STATION	●			●			●						●		
SMOKE DETECTOR ABOVE FACP	●			●			●								
WATERFLOW SWITCH	●			●			●		●						
SMOKE DETECTOR		●			●		●								
SMOKE DETECTOR ELEVATOR LOBBY		●			●		●			●			●		
SMOKE DETECTOR PRIMARY LEVEL		●			●		●				●		●		
HEAT DETECTOR MACHINE ROOM	●	●		●	●		●					●	●		
DUCT SMOKE DETECTOR		●			●		●							●	
TAMPER SWITCH		●			●										
ALARM SILENCE AT FACP OR FSA			●			●		●							
FIRE ALARM TROUBLE CONDITIONS (OPENS, SHORTS OR GROUNDS)			●			●									
MNS PANEL TROULE			●			●									
LOC/ACU MICROPHONE		●				●									●
LOC/ACU PRESET MESSAGE		●				●									●

1. TYPICAL SEQUENCE OF OPERATION MATRIX



2. TYPICAL FIRE ALARM RISER



3. TYPICAL FIRE ALARM DEVICE MOUNTING

FIRE ALARM NOTES

1. PROVIDE AN ANALOG-ADDRESSABLE FIRE ALARM SYSTEM IN ACCORDANCE WITH NFPA 72, IBC , THE NAU FIRE CODE, AND THE SPECIFICATION AND THE SCOPE OF WORK DOCUMENTS. THE FACP SHALL DISPLAY THE LOCATION OF THE DEVICE IN ALARM OR TROUBLE MODE.
2. THE FIRE ALARM SYSTEM SHALL MONITOR ALL SPRINKLER SYSTEM ALARM, SUPERVISORY AND TROUBLE CONDITIONS.
3. AIR HANDLING UNITS OVER 2000 CFM SHALL HAVE DUCT SMOKE DETECTORS INSTALLED ON THE RETURN DUCTS IN ACCORDANCE WITH IMC.
4. DEVICE LOCATION IS DIAGRAMMATIC. CONTRACTOR SHALL BE RESPONSIBLE FOR AVOIDING ALL CONFLICTS WITH LIGHTING FIXTURES, DIFFUSERS, GRILLS, DUCTS, CABLES, CONDUITS, UTILITY PIPING AND ALL OTHER OBSTRUCTIONS ENCOUNTERED.

LEGEND - FIRE ALARM

- P - MANUAL PULL STATION
- XX - FIRE ALARM STROBE (WALL-MOUNTED)
- XX - FIRE ALARM STROBE (CEILING-MOUNTED)
- XX - FIRE ALARM SPEAKER/STROBE (WALL-MOUNTED)
- XX - FIRE ALARM SPEAKER/STROBE (CEILING-MOUNTED)
- XX - FIRE ALARM SPEAKER (CEILING-MOUNTED)
- XX - FIRE ALARM SPEAKER (WALL-MOUNTED)
- R/F - COMBINATION RATE-OF-RISE / FIXED TEMPERATURE HEAT DETECTOR
- BT/BR - BEAM SMOKE DETECTOR - TRANSMITTER / RECEIVER
- PHOTOELECTRIC SMOKE DETECTOR
- FACP - FIRE ALARM CONTROL PANEL
- MM - MONITOR MODULE
- MR - HEAVY DUTY RELAY MODULE
- R - RELAY MODULE
- Z - RELAY MODULE
- SS - SURGE SUPPRESSION
- TVSS - TRANSIENT VOLTAGE SURGE SUPPRESSION
- DACT - DIGITAL ALARM COMMUNICATOR TRANSMITTER
- FSA - REMOTE ANNUNCIATION PANEL WITH MICROPHONE
- EOL - END OF LINE RESISTOR
- VALVE TAMPER SWITCH
- WATERFLOW SWITCH
- XX - INDICATES CANDELA RATING
- EX - EXISTING DEVICE

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Project For

TAYLOR PLACE DORMITORY

Project No.	2085.003.02
Drawn By	HJM
Checked By	CST
Date	2/15/16

Revisions

No.	Date	Description

DETAILS – FIRE ALARM

FA.501

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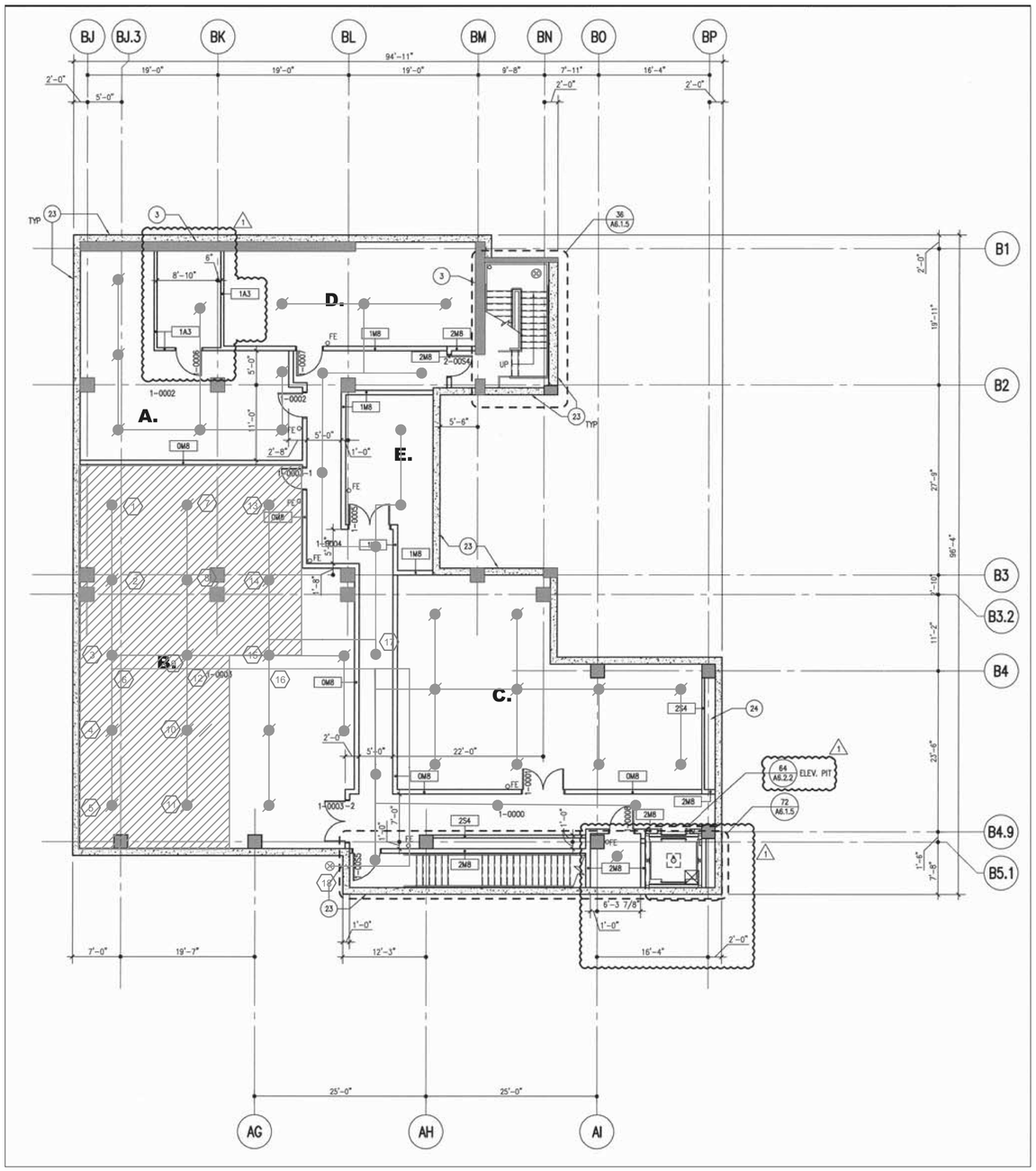

NOTES:
1. SEE SHEET FX501 FOR FIRE PROTECTION NOTES AND DETAILS.
2. SINGLE SPRINKLER LOCATED 2 FEET ABOVE THE FLOOR OF THE ELEVATOR SHAFT.
3. THE OWNER IS RESPONSIBLE FOR MAINTAINING ALL AREAS PROTECTED BY WET PIPE SPRINKLERS, OR WHERE SPRINKLER SUPPLY PIPING IS INSTALLED AT A 40 DEGREES FAHRENHEIT OR GREATER.
4. ALL COMBUSTIBLE CONCEALED SPACES ARE TO BE SPRINKLERED OR PROTECTED IN ACCORDANCE WITH NFPA 13.

SPRINKLER SYMBOL DESCRIPTION									
Symbol	Type	Finish	Temp	K-Factor	N.P.T.	Response	S.I.N.	Make	Total
	PENDANT	WHITE	155.0	8.0	1/2"	QUICK	TY4231	TYCO	44
	PENDANT	WHITE	155.0	5.6	1/2"	QUICK	TY3231	TYCO	9
TOTAL SPRINKLERS SHOWN ON THIS SHEET									53
TOTAL SPRINKLERS REQUIRED ON THIS CONTRACT									TBD

LEGEND - FIRE PROTECTION

- LIGHT HAZARD
  0.10 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- ORDINARY HAZARD, GROUP I
  0.15 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- ORDINARY HAZARD, GROUP II
  0.20 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- EXTERIOR EAVE (SUBJECT TO FREEZING - DRY PIPE OR DRY PENDANT)
  ORDINARY HAZARD, GROUP I
  0.20 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- BACKFLOW PREVENTER TEST HEADER
- FIRE DEPARTMENT CONNECTION
- SPRINKLER RISER
- 24 VDC ELECTRIC BELL

BACKFLOW PREVENTER TEST HEADER

PLAN NORTH

1 FA101 BASEMENT FLOOR PLAN - FIRE ALARM

SCALE: 1/8" = 1'-0"

GRAPHIC SCALE
8 0 8 16
SCALE: 1/8" = 1'-0"

Certification

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Arizona State University

CIVIL ENGINEER

FIRE / LIFE SAFETY CONSULTANT

STRUCTURAL ENGINEER

MEP ENGINEER

Project For

TAYLOR PLACE DORMITORY

Project No. 2085.003.02
Drawn By HJM
Checked By CST
Date 2/12/16

Revisions

No.	Date	Description

BASEMENT FLOOR PLAN
FIRE PROTECTION

FA.A2-00

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NOTES:
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4. ALL COMBUSTIBLE CONCEALED SPACES ARE TO BE SPRINKLERED OR PROTECTED IN ACCORDANCE WITH NFPA 13.

Stair 3

Stair 4

Stair 1

Stair 2

A.

B.

C1.

C2.

D.

E.

F.

BUILDING 2 – SHEET 2–A2.01
BUILDING 1 – SHEET 1–A2.01

SPRINKLER SYMBOL DESCRIPTION									
Symbol	Type	Finish	Temp.	K-Factor	N.P.T.	Response	S.I.N.	Make	Total
	PENDANT	WHITE	155.0	8.0	1/2"	QUICK	TY4231	TYCO	76
	PENDANT	WHITE	155.0	5.6	1/2"	QUICK	TY3231	TYCO	149
TOTAL SPRINKLERS SHOWN ON THIS SHEET									225
TOTAL SPRINKLERS REQUIRED ON THIS CONTRACT									TBD

PLAN NORTH

1 FA102 FIRST FLOOR PLAN - FIRE PROTECTION

SCALE: 1/8" = 1'-0"

LEGEND - FIRE PROTECTION

- LIGHT HAZARD
  0.10 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- ORDINARY HAZARD, GROUP I
  0.15 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- ORDINARY HAZARD, GROUP II
  0.20 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- EXTERIOR EAVE (SUBJECT TO FREEZING - DRY PIPE OR DRY PENDANT)
  ORDINARY HAZARD, GROUP I
  0.20 GPM/SF OVER HYDRAULICALLY MOST REMOTE 1,500 SF
- BACKFLOW PREVENTER TEST HEADER
- FIRE DEPARTMENT CONNECTION
- SPRINKLER RISER
- 24 VDC ELECTRIC BELL

GRAPHIC SCALE
8 0 8 16
SCALE: 1/8" = 1'-0"

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FIRST FLOOR FIRE PROTECTION

FX.A2–01

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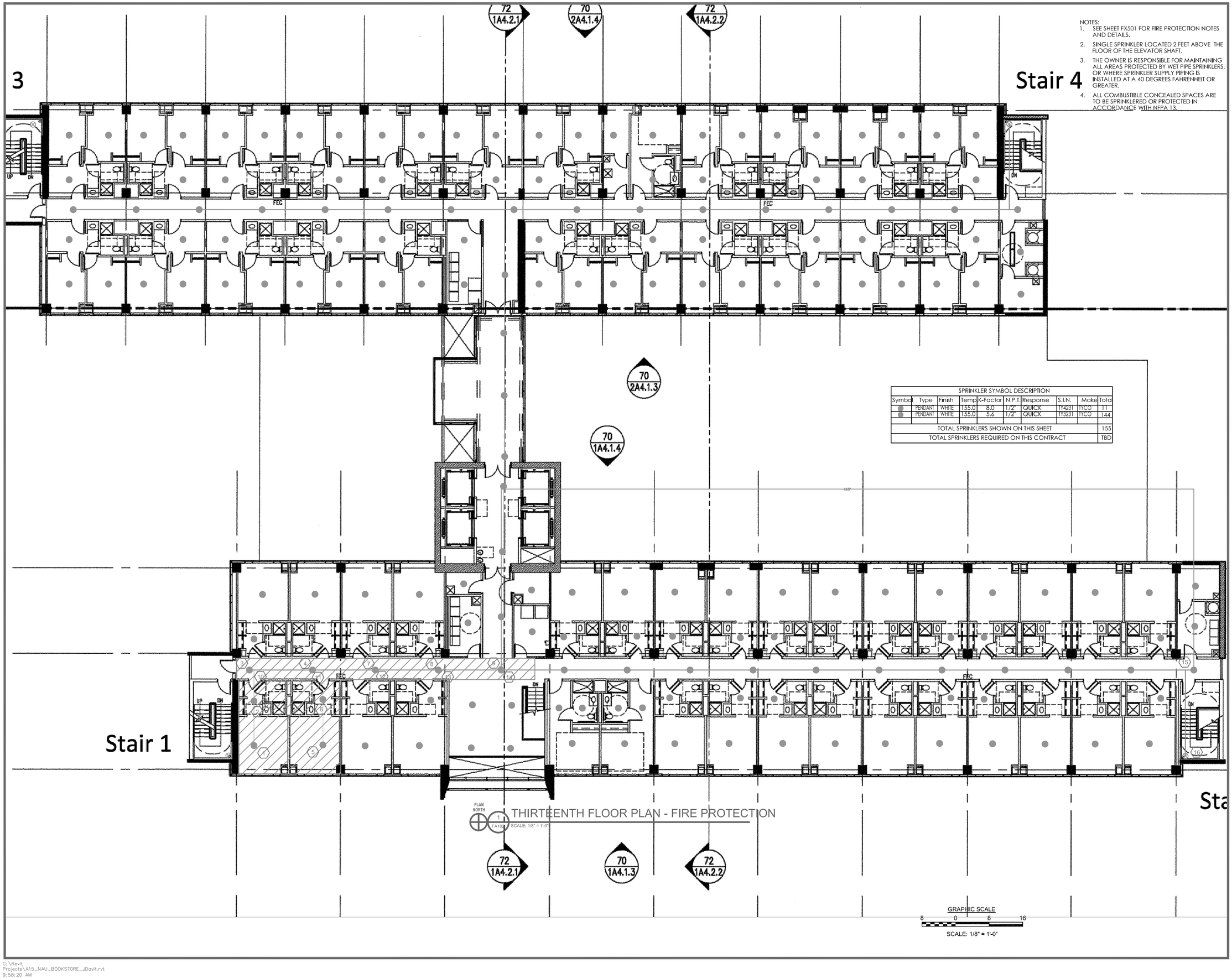

NOTES:
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2. SINGLE SPRINKLER LOCATED 2 FEET ABOVE THE FLOOR OF THE ELEVATOR SHAFT.
3. THE OWNER IS RESPONSIBLE FOR MAINTAINING ALL AREAS PROTECTED BY WET PIPE SPRINKLERS, OR WHERE SPRINKLER SUPPLY PIPING IS INSTALLED AT A 40 DEGREES FAHRENHEIT OR GREATER.
4. ALL COMBUSTIBLE CONCEALED SPACES ARE TO BE SPRINKLERED OR PROTECTED IN ACCORDANCE WITH NFPA 13.

SPRINKLER SYMBOL DESCRIPTION									
Symbol	Type	Finish	Temp	K-Factor	N.P.T.	Response	S.I.N.	Make	Total
	PENDANT	WHITE	155.0	8.0	1/2"	QUICK	TY4231	TYCO	11
	PENDANT	WHITE	155.0	5.6	1/2"	QUICK	TY3231	TYCO	144
TOTAL SPRINKLERS SHOWN ON THIS SHEET									155
TOTAL SPRINKLERS REQUIRED ON THIS CONTRACT									TBD

GRAPHIC SCALE
8 0 8 16
SCALE: 1/8" = 1'-0"

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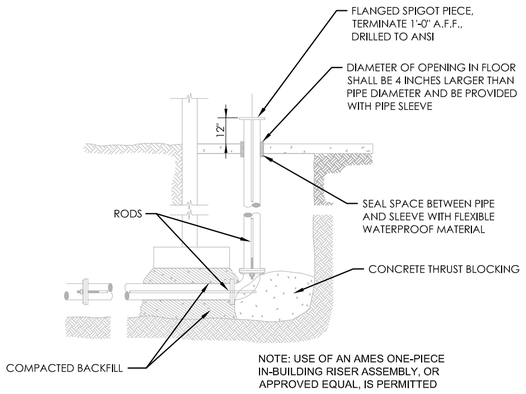
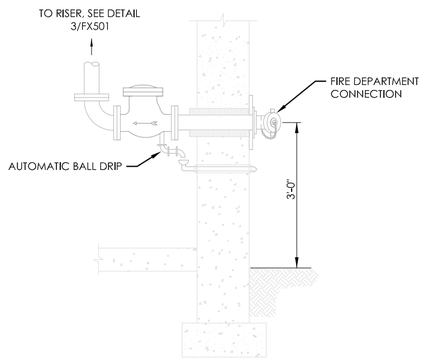
THIRTEENTH FLOOR PLAN
FIRE PROTECTION

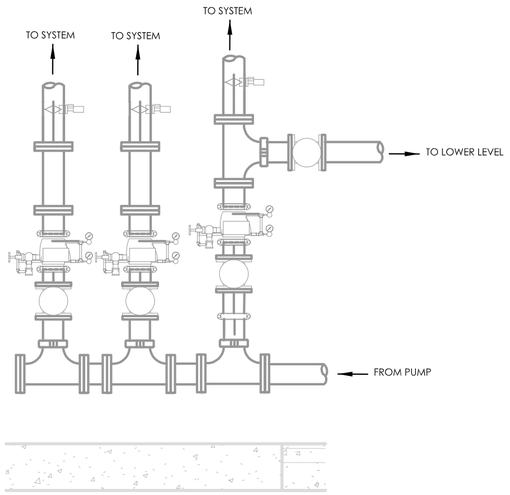
FX.A2–13



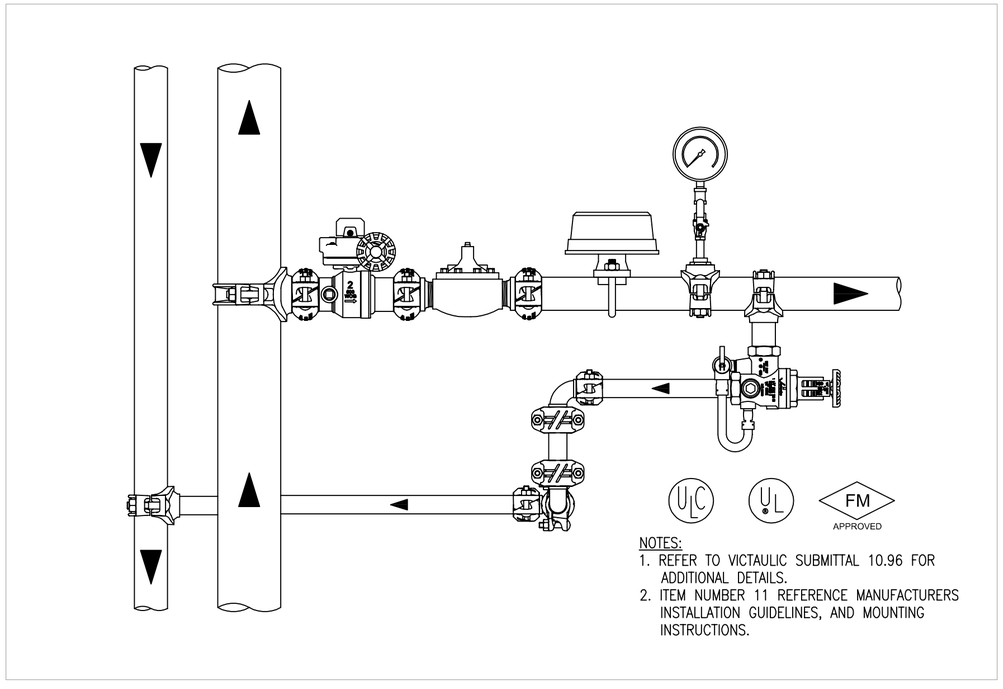
1. TYPICAL LEAD-IN



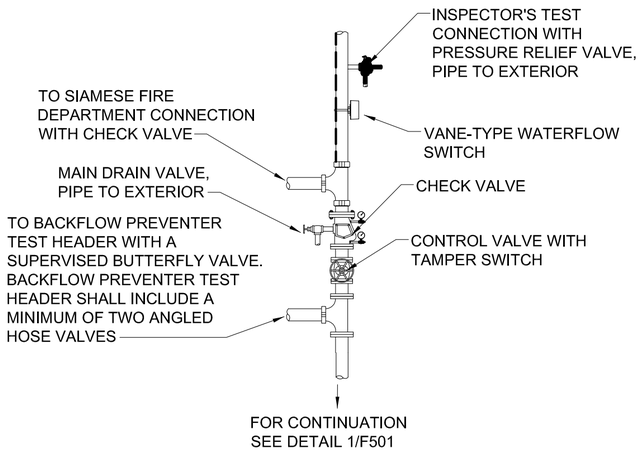
2. TYPICAL FIRE DEPARTMENT CONNECTION



3. TYPICAL RISER MANIFOLD



4. TYPICAL FLOOR CONTROL VALVE ASSEMBLY



5. TYPICAL RISER DETAIL

FIRE PROTECTION NOTES

1. THE CONTRACTOR SHALL HYDRAULICALLY DESIGN AN AUTOMATIC WET PIPE FIRE SPRINKLER SYSTEM IN ACCORDANCE WITH NFPA 13 AND THE NAU FIRE CODE. SPRINKLERS SHALL BE INSTALLED IN ALL AREAS REQUIRED TO BE PROTECTED BY NFPA 13 AND IBC.
2. CONTRACTOR SHALL PROVIDE ALL NECESSARY AUXILIARY DRAINS AND INSPECTORS' TEST CONNECTIONS AS REQUIRED BY NFPA 13. INSPECTORS' TEST CONNECTIONS DRAINS SHALL DISCHARGE TO A SAFE LOCATION OUTSIDE THE BUILDING.
3. ALL PIPE 2 INCHES AND SMALLER SHALL BE SCHEDULE 40 ONLY. PIPE LARGER THAN 2 INCHES CAN BE SCHEDULE 10.
4. ALL PIPE 2 INCHES AND SMALLER SHALL BE THREADED. ALL PIPE LARGER THAN 2 INCHES MAY BE THREADED, FLANGED, OR ROLL GROOVED.
5. CONTRACTOR SHALL PROVIDE ALL NECESSARY PIPE HANGERS AND SUPPORTS AS REQUIRED BY NFPA 13.
6. ALL VALVES CONTROLLING WATERFLOW TO THE SPRINKLER SYSTEM SHALL BE PROVIDED WITH TAMPER SWITCHES TO BE CONNECTED TO THE FIRE ALARM SYSTEM BY THE FIRE ALARM CONTRACTOR.
7. ALL PENETRATIONS THROUGH FIRE-RESISTANT ASSEMBLIES SHALL BE PROTECTED BY A UL-LISTED THROUGH-PENETRATION FIRESTOP SYSTEM. ALL PENETRATIONS THROUGH SMOKE PARTITIONS SHALL BE SEALED WITH NON-COMBUSTIBLE MATERIAL .
8. CONTRACTOR SHALL BE RESPONSIBLE FOR AVOIDING ALL CONFLICTS WITH LIGHTING FIXTURES, DIFFUSERS, GRILLS, DUCTS, CABLE TRAYS, CABLE BUNDLES, CONDUIT, UTILITY PIPING AND ALL OTHER OBSTRUCTIONS ENCOUNTERED.
9. CONTRACTOR SHALL VERIFY ELEVATIONS AND LOCATIONS OF NEW SPRINKLER PIPING AND EQUIPMENT PRIOR TO INSTALLATION.
10. CONTRACTOR SHALL TAKE ALL NECESSARY MEASURES TO KEEP THE PREMISES DRY AT ALL TIMES AND TO PREVENT WATER DAMAGE. CONTRACTOR SHALL REPAIR WATER DAMAGE RESULTING FROM THE WORK, WHETHER INTENTIONAL OR NOT, AT NO COST TO, AND TO THE SATISFACTION OF THE OWNER.
11. NEITHER THE OWNER NOR THE ENGINEER SHALL BE RESPONSIBLE FOR PROVIDING A SAFE WORKING PLACE FOR THE CONTRACTOR, SUBCONTRACTORS, OR THEIR EMPLOYEES, OR ANY OTHER INDIVIDUAL RESPONSIBLE TO THEM FOR THE WORK. THIS RESPONSIBILITY RESTS SOLELY ON THE CONTRACTOR'S PROJECT SUPERINTENDENT.

Certification

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STRUCTURAL ENGINEER

MEP ENGINEER

Project For

TAYLOR PLACE DORMITORY

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Revisions

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DETAILS – FIRE PROTECTION

FX.501

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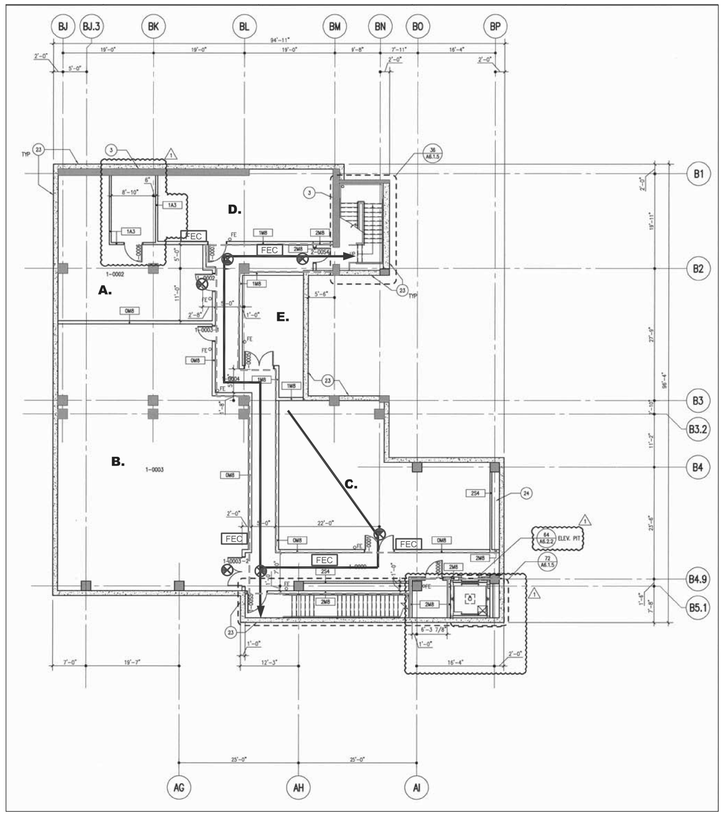
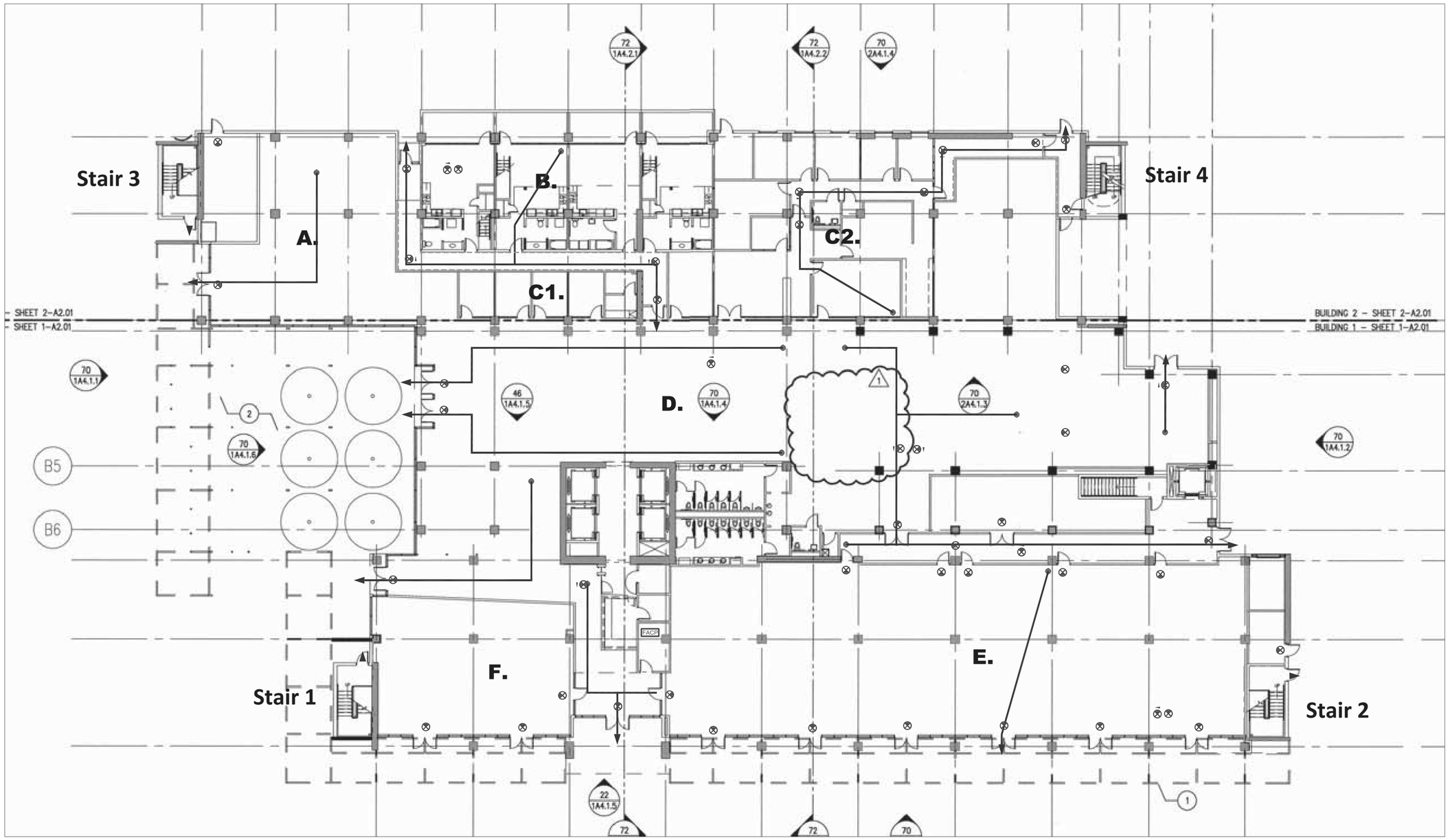
NOTES:
1. ARCHITECTURAL SCOPE IDENTIFIED IN CALLOUT BOXES.

2. INSTALL NEW EXIT SIGN AS INDICATED.



NOTES:
1. SEE SHEET FA501 FOR FIRE ALARM NOTES AN DETAILS.
2. ALL MANUAL PULL STATIONS SHOWN ARE EXISTING UNLESS OTHERWISE NOTED.
3. REDUCE CANDELA SETTING TO 15CD.



PLAN NORTH
1 FA102
FIRST FLOOR PLAN - LIFE SAFETY
SCALE: 1/8" = 1'-0"

LEGEND
- EGRESS PATHS
- 1/2 HOUR FIRE BARRIER
- 1-HR FIRE BARRIER
- 2-HR FIRE WALL
- XXX CALCULATED OCCUPANT LOAD
- XX / XX NUMBER OF OCCUPANTS USING EXIT / EXIT CAPACITY
- AREA OUTSIDE SCOPE OF WORK
- 1-HR ROOF / CEILING ASSEMBLY ABOVE
- SPRINKLER RISER
- FEC SEMI-RECESSED FIRE EXTINGUISHER CABINET
- EXIT SIGN
- FACP FIRE ALARM CONTROL PANEL

GRAPHIC SCALE
8 0 8 16
SCALE: 1/8" = 1'-0"

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FIRST FLOOR PLAN
LIFE SAFETY

G2.A2-01

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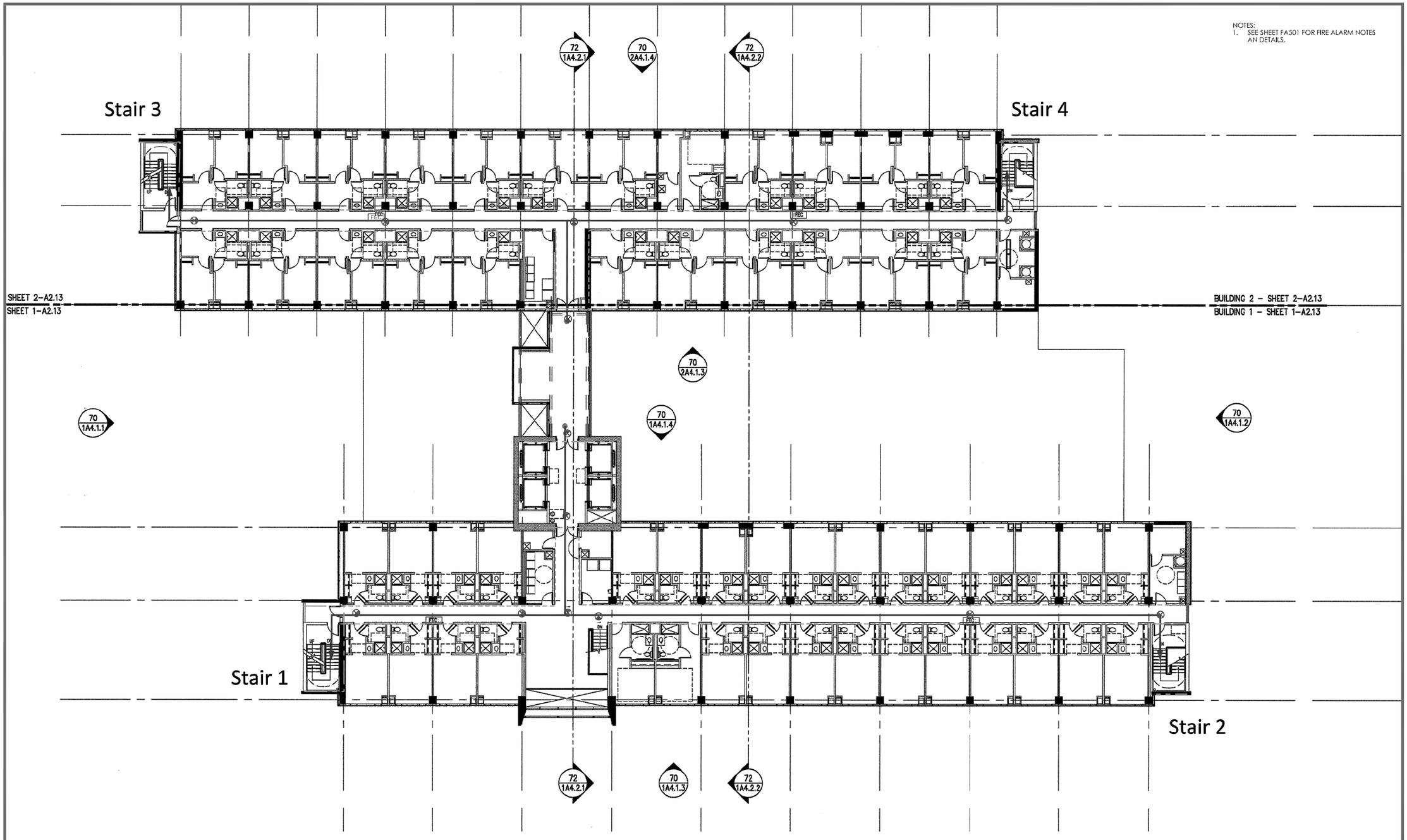
NOTES:
1. SEE SHEET FA501 FOR FIRE ALARM NOTES AN DETAILS.



PLAN NORTH

1 FA102 THIRTEENTH FLOOR PLAN - LIFE SAFETY

SCALE: 1/8" = 1'-0"

LEGEND
- EGRESS PATHS
- 1/2 HOUR FIRE BARRIER
- 1-HR FIRE BARRIER
- 2-HR FIRE WALL
- XXX — CALCULATED OCCUPANT LOAD
- XX / XX — NUMBER OF OCCUPANTS USING EXIT / EXIT CAPACITY
- AREA OUTSIDE SCOPE OF WORK
- 1-HR ROOF / CEILING ASSEMBLY ABOVE
- SPRINKLER RISER
- FEC — SEMI-RECESSED FIRE EXTINGUISHER CABINET
- EXIT SIGN
- FACP — FIRE ALARM CONTROL PANEL

GRAPHIC SCALE
8 0 8 16
SCALE: 1/8" = 1'-0"

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THIRTEENTH FLOOR PLAN
LIFE SAFETY

G3.A2–13

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APPENDIX G
FIRE ALARM PRODUCT DATA SHEETS

EST3

Features

- **168 character LCD**
  - displays information important to user first
  - First and Last alarm display hands free
- **Exceptional alarm response times**
  - 3 second alarm response time over any size network
  - 750ms loop alarm response time
- **Total network wiring over 300,000 feet**
- **Eight multiplexed channels for audio source selection on one pair of wires**
- **Zoned audio amplifiers**
- **Supports proprietary and local system operations**
- **For retrofit existing wire may be used if electrically sound**
- **Slide in LED and switch labels**
- **Signature series detectors and modules support**
- **Automatic device and panel addressing**
- **250 devices per loop, 2500 devices per node**
- **Device circuit mapping**
- **Up to 32 trouble bits per device for trouble shooting**

Description

EST3 is a modular system uniquely designed to easily meet the needs of standalone single node systems or multi-node networks. Both fire alarm and audio systems use the same fundamental components simplifying system layouts. A powerful System Definition Utility helps define flexible system operations in a fraction of the time required by others. Virtually all EST3 operating features are software controlled. This gives EST3 great site flexibility and ensures operational changes and upgrades will be possible years after the initial installation.

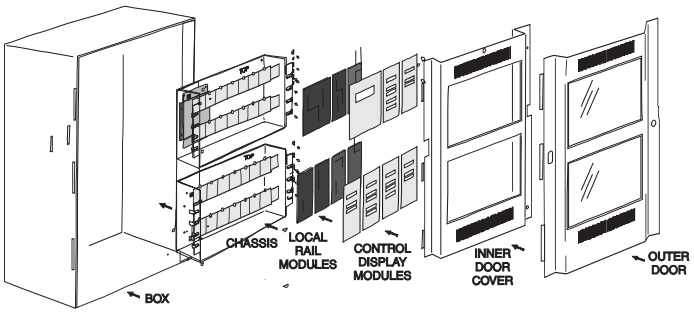
From the elegant contoured door design of the Lobby Enclosure through the standard industrial design of Remote Closet cabinets both aesthetics and function are addressed.

Application Notes

EST3 is a superbly adaptable Life Safety System lending itself to smaller and larger buildings alike. System components arrange in layers starting with the wallbox system and ending with inner and outer doors. Cabinets are available with room for system batteries up to 65 Amp hours. With EST3 one 24 volt battery supports up to four power supplies.

The power supplies use a unique paralleling arrangement that ensures optimization of each supplies full capacity. Each supply will support up to 7 Amps of load, with four supplies 28 Amps of current is available all backed up by one battery. This gives EST3 continuing cost saving benefits in system maintenance as well as initial system cost.

A user interface layer made up of a Main Display Interface module and a system of generic modules maximize design flexibility for custom systems.



Main Display Interface
EST3's Main Display Interface module focuses on the emergency user. Simple to understand lights and switches help the operator execute system commands with confidence. Eight lines of 21 characters (168 characters total) provide the room needed to convey emergency information in a useful format. Hands free, the first highest priority event displays. The Main Display always shows the last highest priority event. Without opening the door of the EST3 the first and last alarm is given. EST3 modular system design means a Main Display Interface module is not required in remote nodes with no user interface requirements.

EST3's Main Display Interface provides a menu system to support maintenance functions such as point disabling or reports for use by staff or service personnel.

Display Modules
EST3's, generic control/display module's provide membrane switches with positive tactile feedback and colored LEDs giving the emergency user the simplest of interfaces. Control/Display module locations are independent of the underlying connection hardware, the local rail module. This keeps system lay out flexibility maximized.

Panel Capacities
EST3 makes isolation of field wiring easy with building wiring termination's being made on local rail module removable terminal blocks. EST3 local rail modules include, zoned amplifiers, Single Signature Loop Controllers, Conventional Hardwired modules, and the main CPU module. System design allows convenient separation of high voltage and power limited wiring.

EST3 supports both single node and multiple node single network systems. As a stand alone panel or single node from 5 to 21 module spaces are available. This provides enough space for up to four system power supplies providing 28 Amps of power. A single panel supports up to 10 Signature loop controllers (250 devices per loop, 2500 points total per node). Utilizing conventional circuits, up to 15 local rail modules fit, supporting 120 conventional zones. Up to half of the conventional circuits could be Notification Appliance Circuits, with 19 Control Display modules, and a Main Display Interface module.

Networks
EST3 operates on a multi priority peer-to-peer token ring network. The multi-priority token ring gives EST3 exceptional alarm response. Response time is less than 3 seconds across the network virtually independent of the total number of nodes. EST3 token ring network configuration also affords long distances between nodes. The distance between panels on #18AWG (1.0mm^2) is 5000ft (1523m). With 64 nodes supported on a network the total network length is in excess of 300,000 ft (91400m).

Network communication is via RS-485 serial ports. This two wire circuit supports Class 'A' or 'B'. The EST3 network meets NFPA style 7 communications standards in Class 'A' configuration.

The EST3 uses distributed data base technology, designed to survive the rigors of fire and fire fighting. In Class 'B' configuration a single break or short on the network wiring will isolate the system into two groups of panels each with one or more nodes. Each group of panels continues functioning as a peer-to-peer network working with their combined data bases. In Class 'A' a single break or short on the network wiring causes the system to isolate the fault. Network communication continues uninterrupted. If multiple faults occur, the network re-configures into multiple networks and functions as described above for Class 'B'. This means a system continues to respond to activations from every node that can transmit and receive network messages. Local responses always execute since the local data base resides at each node maximizing survivability.

Adding Audio
EST3 audio is a matter of selecting components for installation in standard fire alarm cabinet assemblies. EST3 uses intelligent zoned amplifiers, this reduces wire runs and space needs at a central location. Audio control equipment and zoned amplifiers use the same system power supplies as fire alarm components. All these components are supported by standby battery. Where multiple nodes make up the system a single pair of wires carries eight channels of digital audio between nodes. The system will deliver up to eight messages/signals simultaneously meaning occupants signaling messaging is never interrupted. This eliminates confusion when the emergency user requires the use of an audio channel when delivering zone specific messages.

The EST3 provides simple paging controls. Pressing the ALL CALL selects all paging zones for message delivery. Pressing Page to EVACUATION automatically selects all areas in evacuation. Similarly, the user can Page to ALERT. Zoned paging requires the user to simply press zone paging switches. After the user completes a page delivery, signaling automatically restore when the user releases the microphone talk key.

Engineering Specification

It shall be possible to support a single stand alone node or up to 64 nodes communicating on a peer-to-peer multi-priority token ring protocol network. Any node on the network with a new alarm must have priority on the Network. Network alarm response must be under 3 seconds. Field wiring connections must be made at removable terminal blocks. Status LEDs shall be provided for communications of network, RS-232, audio and internal rail communications. Internal node communication speed must be programmable. The control panel and system components must be manufactured by an ISO 9001 standards listed company.

The communication format between the control panel and analog devices shall be digital.

Loop alarm recognition must be within 750 milliseconds of a device reporting an alarm state. It must be possible to wire the Loop as Class A or Class B with non shielded, non twisted wire. It must be possible to wire branches (T-taps) with Class B wiring. Should the communications between devices and the Data controller be lost, the device circuit shall go into stand-alone mode. The circuit shall act like a conventional alarm receiving circuit in the stand alone mode. Should bus communications be lost, local rail modules must continue to function, recognize and store functional status changes. In the event of an alarm, provision must be made to signal the network and make it aware of the alarm condition.

The fire alarm power supplies must be capable of being paralleled and share the load. Multiple power supplies must be capable of being backed up with a single 24 volt battery pack for reduced maintenance. A battery per power supply is not acceptable. The power supply shall be capable of charging up to 65 AH batteries. The power supply must be able to perform an automatic load test of batteries and return a trouble if the batteries fall outside a predetermined range. Power supplies must incorporate the ability to adjust the charge rate of batteries based on ambient temperatures. It shall be possible to adjust for ambient temperature changes in local cabinets as well as remote cabinets.

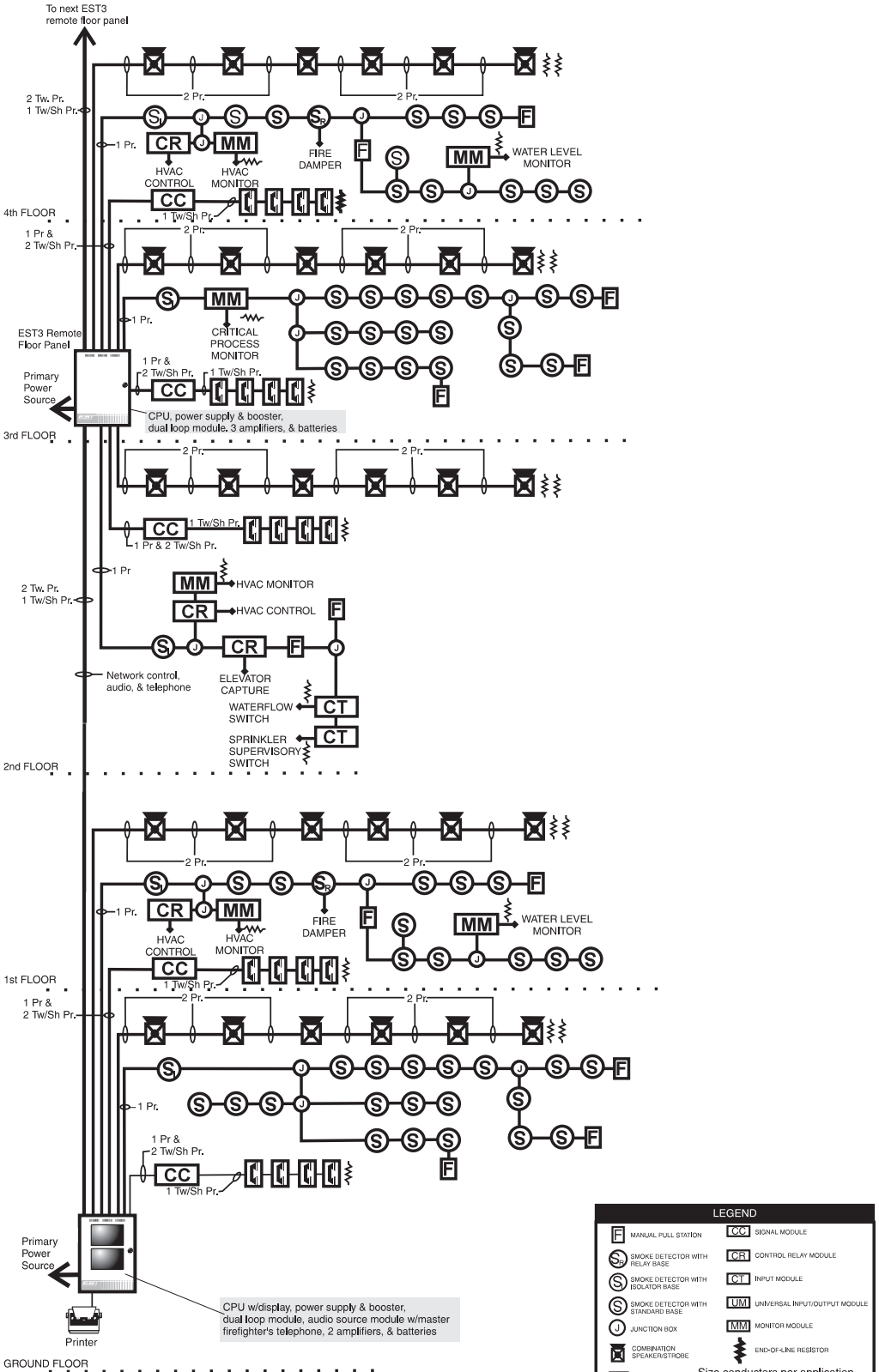
The system shall provide a user interface that displays system events in a text format, and supports basic common control LEDs and switches. The Common Control Switches and LEDs provided as minimum will be; Reset switch and LED, Alarm Silence switch and LED, Panel Silence switch and LED, Drill switch and LED. It must be possible to add additional common controls as required through the use of modular display units. The user interface must provide an LCD that will allow custom event messages of up to 42 characters. The system must provide the emergency user, hands free viewing of the first and last highest priority event. The last highest priority event must always display and update automatically. Events shall be automatically placed in easy to access queues. It shall be possible to view specific event types separately. Having to scroll through a mixed list of event types is not acceptable. The total number of active events by type must be displayed. Visual indication must be provided for any event type that has not been acknowledged or viewed. It must be possible to customize the designation of all user interface LEDs and Switches for local language requirements.

The Life Safety system shall incorporate annunciation of Alarm, Supervisory, Trouble and Monitor operations. Annunciation must be through the use of LED display strips complete with a means to custom label each LED as to its function. Where applicable control of remote smoke control devices must be made available at the control center. Switches with LEDs must provide positive feed back to the operator of remote equipment status. Where voice audio is required a means of paging individual zones must be made. The status of each paging zone must be annunciated. It must be possible to selectively page into specific zones. It shall be possible to manipulate the evacuation of the building from the main control center. It must be possible for the emergency operator to put specific zones into evacuation manually.

The audio system amplifiers must be able to operate 25Vrms or 70.4Vrms speakers. The system shall provide simultaneous page, alert and evacuation signaling. Systems that cause signaling devices to go silent while performing any signaling functions will not be accepted. System amplifiers must be distributed zoned type. Centrally banked systems are not acceptable. An integral circuit for operating traditional NAC devices must be provided with each system amplifier. The circuit must have a minimum rating of 3.5 Amps for operating 24Vdc signals. It must be possible to have up to 8 separate audio signal sources for paging and signaling purposes. The system must provide as a minimum the following paging common controls and indicators: Ready to page LED, VU display of paging output level, single switch function for paging to all - Alert zones, Evacuation zones, and areas not programmed for signaling. The system must provide high quality analog to digital conversion of paging sources. Digital transmission of paging must be provided between system nodes. The analog sources must be sampled and converted to digital with a sampling rate no less than 9600 baud. It must be possible to transmit signal sources (Alert, Alarm, Page, etc.) together over a single pair of wires between nodes.

The fire panel shall be capable of supporting a variety of conventional smoke detectors with a single module. It must be possible to support polarized bells, horns or strobes. It shall be possible to provide hardwired supervisory and monitor functions with latching or non-latching operations. It shall be possible to display any circuit on an LCD or LED annunciator located anywhere on the network.

Typical Wiring



Typical EST3 Wiring with
Emergency Voice/Alarm System w/ Firefighter's Telephones

EST3 Cabinets and Chassis

Models: 3-CAB series, 3-RCC series, 3-CHAS7 series

Features

- **Right or left hand hinging of doors**
- **Lag and Keyway holes for quick mounting**
- **Knockouts for 3/4 inch conduit**
- **Attractive contour door design on lobby enclosures**
- **Combination flush or surface mounting lobby enclosure design**
- **Remote closet cabinets for electrical closet mounting support up to 65 AMP hour batteries**

3-CAB Series

3-RCC Series

Description

EST3 has a wide selection of cabinet arrangements allowing the greatest use of EST3's flexible modular design. From the elegant contoured door design of the lobby enclosure through the standard design of remote closet cabinets both aesthetics and function are easily addressed.

Lobby enclosure wallboxes are manufactured from #14 AWG cold rolled steel with a gray baked enamel finish. Lobby enclosure doors are manufactured from #14 AWG cold rolled steel and have a modern contoured door design with integral viewing window. The exception is the small lobby enclosure 3-CAB5. The 3-CAB5 wallbox and non-contoured door are #16 AWG cold rolled steel. Lobby enclosure doors come with gray baked enamel or optional red baked enamel finishes. The EST3 lobby enclosures back boxes, doors and chassis units are ordered and shipped separately. The 3-CAB5 lobby enclosure comes complete with door and back box providing space to mount five local rail modules.

The EST3 remote closet cabinet design allows the installation of control panel electronics in electrical closets. The remote closet cabinets have left hand hinged doors and are available with red finish only. Optional display modules used for system diagnostics display, mount behind the closet cabinet door and are not visible with the door closed.

Application

Lobby Enclosures

EST3 lobby enclosures provide space for control, monitoring and display modules. Ideal for mounting in lobby's where appearance is important, maximum mounting flexibility is provided with doors that will mount for right or left hand opening. Lobby enclosures come in several sizes to match individual project requirements.

The **3-CAB5 series** semi-flush or surface mounts. A built in rail assembly provides space for up to five local rail modules, no chassis assembly needed. Back space for 1-1/2 footprints gives room for a power supply and a 1/2 footprint module and 10 AH batteries. The local rail module spaces provide room for amplifiers, common control and annunciation modules.

The **3-CAB7** semi-flush or surface mounts and has a contoured front door with viewing window. Space is provided for two 17 AH batteries and one chassis assembly providing seven local rail module spaces.

The **3-CAB14** semi-flush or surface mounting and has a contoured front door with viewing window. Space is provided for two 17AH batteries and two chassis assemblies each providing seven local rail module spaces.

The **3-CAB21** semi-flush or surface mounts and has a contoured front door with viewing window. Space is provided for two 17AH batteries and three chassis assemblies each providing seven local rail module spaces.

Remote Closet Cabinets

Remote closet cabinets provide an economical way of installing equipment in locations where esthetics are not paramount, like electrical closets. You can have optional display modules used for system diagnostics display mounted behind the front door. These display modules will not be visible with the door closed. Remote closet cabinets are surface mounting and come in sizes providing space for one to three chassis with room for standby batteries.

Ordering Information

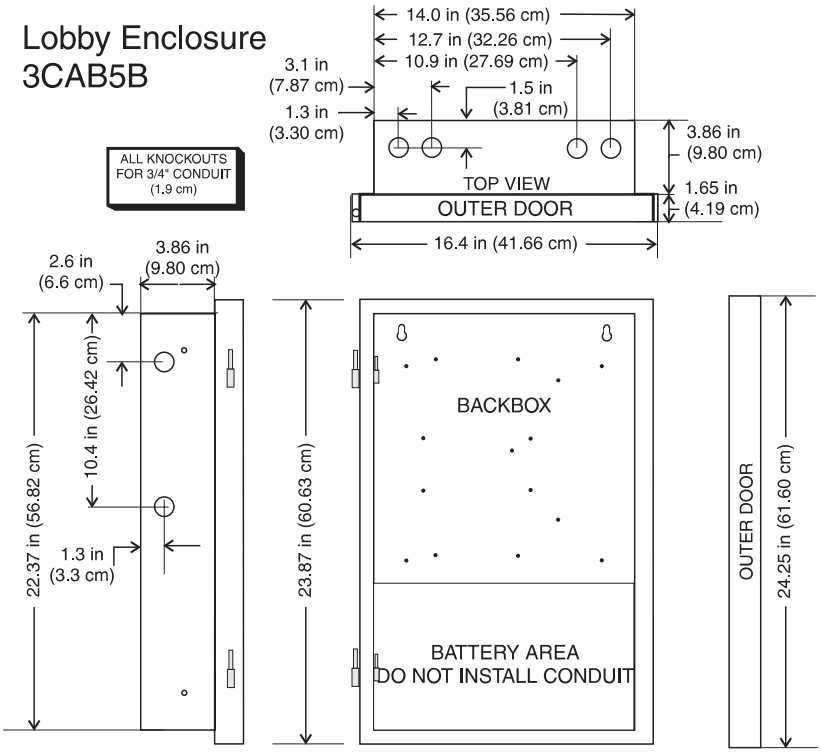
Catalog Number	Description	Equipment Mounting Space	Battery Space	Ship Wt. lb. (Kg)
Lobby Enclosures — Outer doors with viewing window				
3-CAB5	Cabinet w/Wallbox and door	Five local rail modules One footprint and 1/2 footprint module	Two - 12V10A	30 (13.6)
3-CAB7B	Wallbox only	One Chassis	Four - 6V8A Two - 12V10A Two - 12V17A	
3-CAB7B-E	Wallbox only, EN-54 certified CE			
3-CAB7D(R)	Inner and outer doors for 3-CAB7B	N/A		10 (4.5)
3-CAB7D(R)-E	Inner & outer doors for 3-CAB7B, EN-54 certified CE			
3-CAB14B	Wallbox only	Two Chassis	Four - 6V8A Two - 12V10A Two - 12V17A	42 (19.1)
3-CAB14B-E	Wallbox only, EN-54 certified CE			
3-CAB14D(R)	Inner and outer doors for 3-CAB14B	N/A		15 (6.8)
3-CAB14D(R)-E	Inner & outer doors for 3-CAB14B, EN-54 certified CE			
3-CAB21B	Wallbox only	Three Chassis	Four - 6V8A Two - 12V10A Two - 12V17A	55 (25)
3-CAB21B-E	Wallbox only, EN-54 certified CE			
3-CAB21D(R)	Inner and outer doors for 3-CAB21B	N/A		20 (9.1)
3-CAB21D(R)-E	Inner & outer doors for 3-CAB21B, EN-54 certified CE			
Remote Closet Enclosure — No viewing window				
3-RCC7R	Red wallbox and door	One Chassis	Four - 6V8A Two - 12V10A Two - 12V17A Two - 12V50A	37.5 (17)
3-RCC7R-E	Red wallbox and door, EN-54 certified CE			
3-RCC14R	Red wallbox and door	Two Chassis	Four - 6V8A Two - 12V10A Two - 12V17A Two - 12V50A Two - 12V65[2]	53 (24)
3-RCC14R-E	Red wallbox and door, EN-54 certified CE	Two Chassis		
3-RCC21R	Red wallbox and door	Three Chassis		70 (31.8)
3-RCC21R-E	Red wallbox and door, EN-54 certified CE	Three Chassis		
Chassis Assemblies				
3-CHAS7	Chassis Assembly — Takes one chassis space in wallbox, provides seven local rail module spaces, space for up to two power supplies and a 1/2 footprint module.			8.4 (3.8)
3-ASU	Chassis Assembly — Takes one chassis space in wallbox, provides an audio source unit /w microphone and an inner door filler plate.			15 (6.8)
3-ASU/4	Chassis Assembly —-Takes one chassis space in wallbox, provides an audio source unit /w microphone and four local rail module spaces.			15 (6.8)
3-ASU/FT	Chassis Assembly — Takes one chassis space in wallbox, provides an audio source unit /w microphone and Firefighters Telephone			20 (9.1)
3-FTCU	Chassis Assembly — Takes one chassis space in wallbox, provides Firefighters Telephone Control unit and inner door filler plate.			15 (6.8)
Accessories				
3-BATS	Battery Shelf for RCC Enclosures. Takes one chassis space. Room for up to one 65 AH or two 50 AH batteries.			3 (1.36)
3-BTSEN	Battery sensor/distribution module			.5 (.2)
3-TAMP	Tamper switch for 3-CAB7, 3-CAB14 and 3-CAB21 cabinets. Mounts to side of cabinet.			.5 (.2)
3-TAMP5	Tamper switch for 3-CAB5. Mounts to side of cabinet.			.5 (.2)
3-TAMPRCC	3-TAMPRCC Tamper Switch for RCC series cabinets. Mounts to side of cabinet.			.5 (.2)

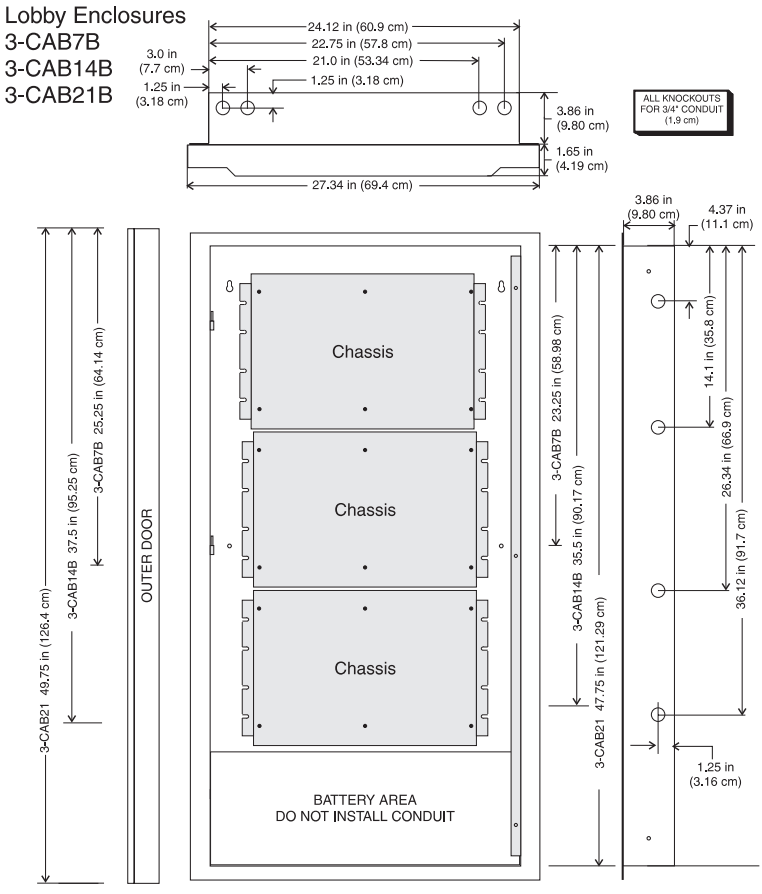
Notes:

1) All lobby enclosures, wallboxes and doors have a textured gray enamel finish; outer doors are available in red by adding the suffix "R" to the catalog number, i.e. 3-CAB7DR.

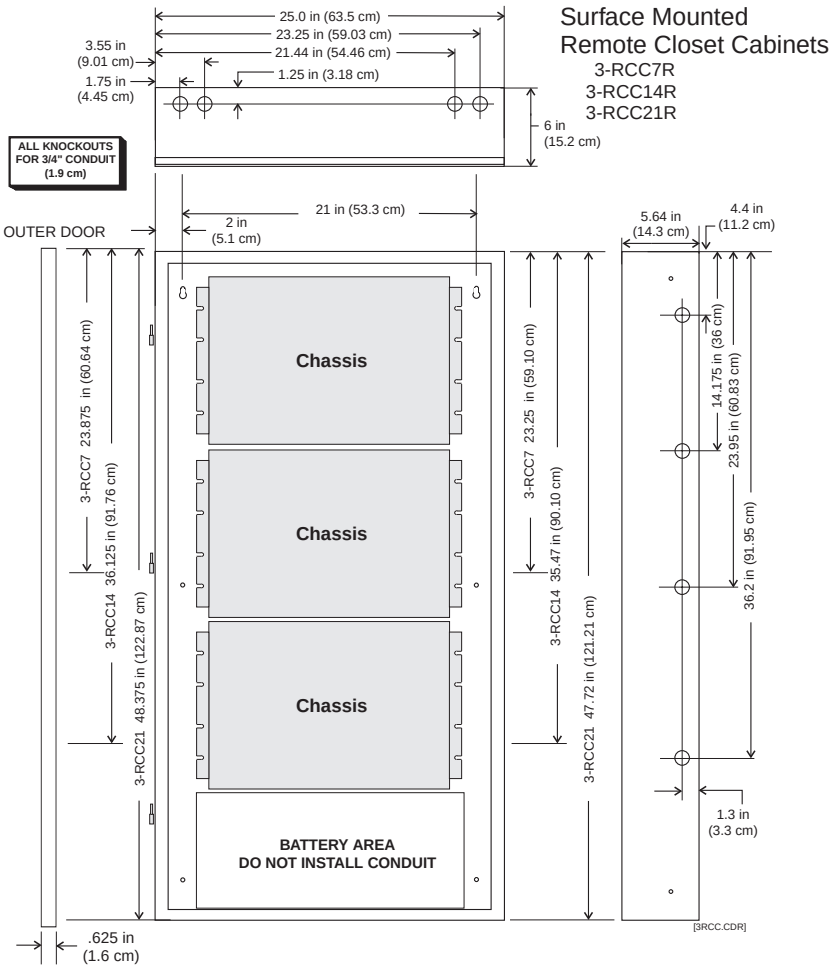
2) Remote closet cabinets will support 65 AH batteries with the use of the 3-BATS Battery Shelf, which reduces the enclosure's chassis capacity by one chassis.

Installation and Mounting





Installation and Mounting



Liquid Crystal Display Module

Model: 3-LCD

Features

- **Uses simple lights and switches**
- **Displays information important to user**
- **Hands free first alarm display**
- **Last event of highest priority always displays**
- **Eight lines by 21 character graphic LCD display — 168 characters total**
- **Multlingual**
  Supports English, French, Spanish, and Russian
- **Uses queues to sort events**
  A queue is a list of messages Alarm, Supervisory, Trouble and Monitor
- **Slide in LED and switch labels**
  Makes customization for regional language easy

Description

The Main Display interface is the primary user interface in the EST3 Life Safety System. The main display interface focuses on the emergency user by putting information important to the user up front. Hands free, the first highest priority event is shown. The display always gives the last highest priority event. Arriving at the panel and without opening the door the first and last alarm is given. Simple to understand lights and switches help the emergency user execute system commands with confidence.

A menu system supports maintenance functions such as disables or reports for use by staff or service personnel.

Application

The 3-LCD module mounts to the local rail over the nodes Central Processing Unit Module (3-CPU). The 3-LCD module is optional in any network node.

Ensuring information clarity the 3-LCD uses a backlit high contrast supertwist graphical display. Eight lines of 21 characters provide the room needed to convey emergency information in a useful format.

The 3-LCD always displays the last highest priority event even when the user is viewing other message queues. Further message flexibility is provided with EST3's message routing ability. Messages from a node can display at every node on the network or messages can route to specific nodes only. Routing can be initiated at a specific time/shift change. There is no need to have messages display in areas that are not affected by an event.

The 3-LCD can display messages in English, Spanish, French, and Russian. The bilingual display lets the operator select between either of two languages. Consult your representative for available language combinations.

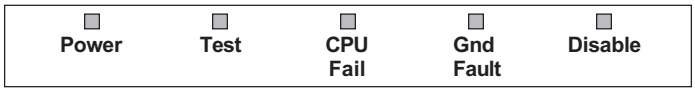
The EST3 system configures for Proprietary, Local or EN54 market operations. The mode of operation is selected through the System Definition Utility (SDU) which may adjust the following operations slightly to fit the system operation selected.

MEA

International Application Notes Available

About LEDs and Switches

Further enhancing the 3-LCD user interface are easy to read and understand lights and switches. All functions are laid out in a logical order. At the top of the 3-LCD are five system status LEDs. Here determining the general condition of the system is easy.



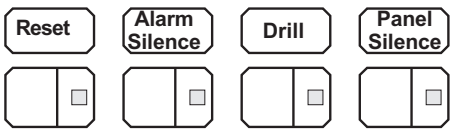
Power LED: Green, on when AC power is on.

Test LED: Yellow, on when any portion of the system (Group) is under test.

CPU Fail LED: Yellow, on when CPU stops running.

Gnd Fault LED: Yellow, on when a ground exists on the system (group)

Disable LED: Yellow, on when any point or zone is disabled by a user.



For EN-54 compliance, please see page 4.

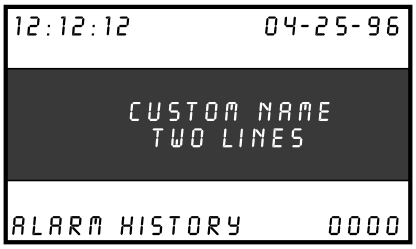
Below the general status LEDs are located four, LED / Switch common controls. The versatility of EST3 allows system designers to define the features as affecting a domain (defined group of nodes) or as global (affects all nodes) across the network. This feature is very useful when configuring systems with multiple buildings on one network. As an example, operating the reset in one building may have adverse effect in other buildings. With EST3 having operational differences between buildings on the same network is not a problem.

Pressing **Reset** starts the system's reset operation. The yellow LED has three flash rates during reset. The LED flashes fast during the smoke power down phase of reset, flashes slow during the restart phase, and turns on steady for the restoral phase. The Reset LED turns off when the system is normal.

Pressing **Alarm Silence** turns off all Notification Appliance Circuits defined as audible. The yellow LED turns on when silence is active via the Alarm Silence switch or via alarm silence software timers.

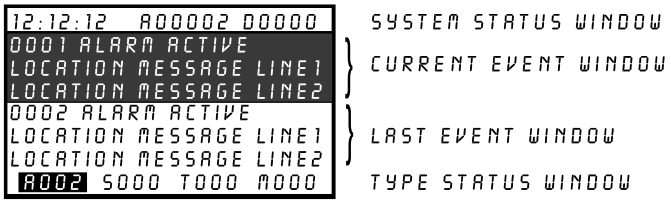
Pressing **Panel Silence** turns off the system's internal audible signal. The yellow LED turns on when panel silence is active. The EST3 panel buzzer has user programmable signal rates for alarm, supervisory, trouble and monitor conditions.

Pressing **Drill** turns on the drill LED and all signals sound evacuation. Drill does not activate city tie connections. Auxiliary relays will not activate unless programmed to do so with drill.



In the center of the 3-LCD is the Liquid Crystal Display. In the normal condition the date and time plus a definable system title display on the LCD. The last line of the display gives an alarm history. This total equals the number of times the system has entered the alarm state from the normal state.

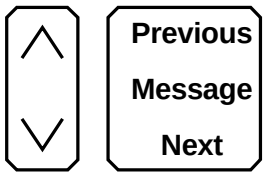
When active events are on display, the LCD formats into four logical windows.



In the system status window, the display shows the time and the status of active and disabled points.

The current event window, lines 2, 3, 4 automatically display the first active event of the highest priority if the user has not taken control of the system. Once the emergency user takes control, this window displays user message selections.

The second line of the display shows system event information. In the example above the display shows the chronological number of the event (0001 is the first alarm) followed by the event type (Alarm Active). EST3 supports over 45 event type messages from which system designers choose. The last two lines of the current event window are custom programmable location message lines with space for 42 characters.

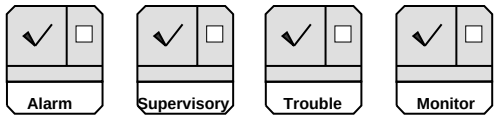


The last event window shows the last highest priority event. This window is always displayed and updated automatically by the system. Here the emergency user can monitor the progress of a fire.

When EST3 is configured for a local mode system viewing the second alarm message is easy, just press the NEXT key. The next message scrolls into the current event window. The last highest priority event always remains on view. No matter what queue the user selects for viewing, the LCD always displays the most recent alarm. A new alarm event resounds the panel audible signal and appears immediately on display without overwriting information the user selected for view.

The final window of the LCD the type status window shows the total number of active events by queue type. A is alarm, S is supervisory, T is trouble, and M is monitor. The number following each letter is the number of active events existing in each queue.

EST3 breaks down event types into queues and automatically displays the first event of the highest priority type.



For EN-54 compliance, please see page 4.

Priority order is alarm, supervisory, trouble, monitor. By using queues an emergency user does not waste time scrolling through a mixed event list looking for alarms or confusing an alarm message with other message types.

EST3 configures for **Remote proprietary** system operation where every event must be acknowledged by viewing them before the internal buzzer will silence. Or the EST3 will configure for **Local** operation. Here the internal buzzer silences by pressing panel silence. If any events exist in queues that have not been viewed the queue LED continues to flash informing the user of un-seen events.

When all events in a queue are acknowledged or 'seen', the LED associated with the queue turns on steady. If a new event is added to the queue, the EST3 internal buzzer resounds and the queue LED flashes.

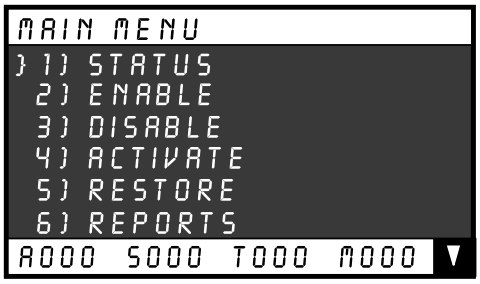
EST3 allows device grouping into logical group zones. Here two or more alarm devices (such as detectors or pull stations) make up the zone. When a device in the zone activates, the LCD displays the zone description. Each zone only displays once, regardless of the number of devices active within the zone.

To display device information the user presses the Details key. The device with the lowest address displays in the first window.

If multiple devices are active each is available for viewing by using the arrow associated with the Previous Message Next key and scrolling through the device list.

The common controls easily expand beyond the Main Display interface by adding a Control Display Module and assigning features to its switch controls.

For Maintenance users, the EST3 provides a smooth operating menu system providing powerful tools for system management, reports, and trouble shooting.



Specifications

Catalog Number	3-LCD
Agency Listings	UL, ULC, FM, CE, EN-54
LCD Display	Eight lines by 21 characters backlit LCD
Mounting	Two local rail spaces on top of 3-CPU
Common Control Switches and LEDs	Reset switch and LED Alarm Silence switch and LED Panel Silence switch and LED Drill Switch and LED
Alarm Current	53mA
Standby Current	53mA

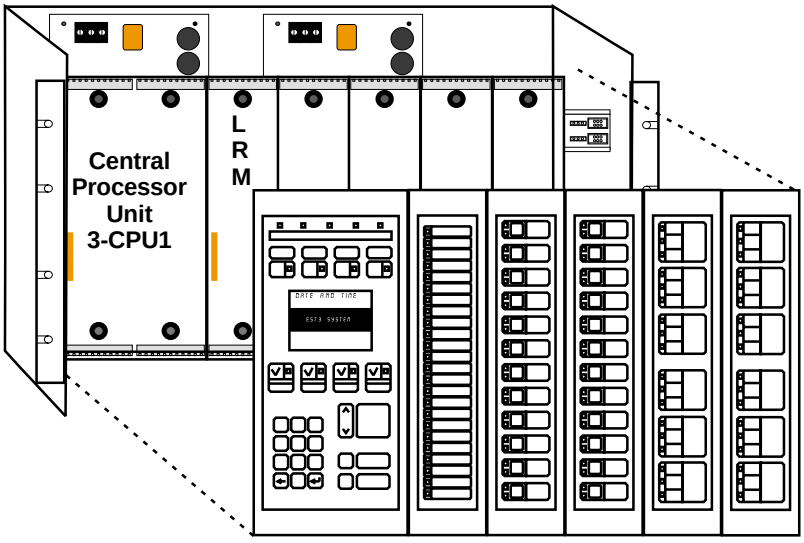
Engineers Specification

The system shall provide a user interface that displays system events in a text format, and supports basic common control LEDs and switches. The Common Control Switches and LEDs provided as minimum will be; Reset switch and LED, Alarm Silence switch and LED, Panel Silence switch and LED, Drill switch and LED. It must be possible to add additional common controls as required through the use of modular display units. The user interface must provide an LCD that will allow custom event messages of up to 42 characters. The interface must provide a minimum of eight lines by 21 characters and provide the emergency user, hands free viewing of the first and last highest priority event. The last highest priority event must always display and update automatically. Events shall be automatically placed in easy to access queues. It shall be possible to view specific event types separately. Having to scroll through a mixed list of event types is not acceptable. The total number of active events by type must be displayed. Visual indication must be provided of any event type which has not been acknowledged or viewed. It must be possible to customize the designation of all user interface LEDs and Switches for local language requirements. It shall be possible to have a custom message for each device in addition to zone messages. Custom device messages must support a minimum of 42 characters each. Instructional text messages support a maximum of 1,000 characters each. The display shall be capable of displaying English, Spanish, French, or Russian messages.

Ordering Information

Catalog Number	Description	Shipping Weight lb. (kg)
3-LCD	Liquid Crystal Display Module	.8 (.36)
3-LKE	UK English Label Kit	.25 (.11)
3-LKF	French Label Kit	.25 (.11)
3-LKR	Russian Label Kit	.25 (.11)
3-LKS	Spanish Label Kit	.25 (.11)

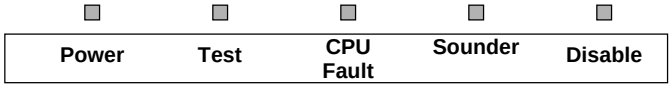
Installation and Mounting



EN-54 Compliance

In 1998 the British-based Loss Prevention Certification Board (LPCB) certified EST3 control panels and power supplies as having surpassed the requirements of the pivotal EN-54 standard, parts two and four. LPCB Certificate #257c for EST3 fire alarm control panels marks the first such certification since the stringent EN54-2 : 1997 and EN54-4 : 1997 were publish by the European Committee for Standarzation (CEN). In order to meet these standards, display and control functions have undergone slight modifications for the EN-54 marketplace. These differences are highlighted below. All other control and annunciation features remain unchanged.

System Status LEDs



Power LED (Green): on when DC power is on.

Test LED (Yellow): on when any portion of the system (Group) is under test.

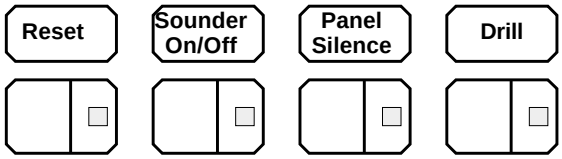
CPU Fault LED (Yellow): on when CPU stops running (processor failures must be manually reset).

Gnd Fault LED: Not available.

Sounder LED (Yellow): flashing indicates fault on sounder circuit. Steady indicates a disabled sounder circuit.

Disable LED (Yellow): on when any point or zone is disabled by a user (disabled conditions have priority over fault conditions).

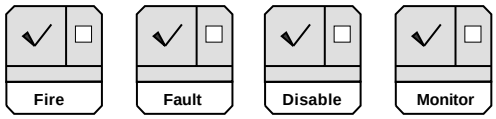
Switch Functions



Pressing **Sounder On/Off** turns off all sounder circuits defined as audible. The yellow LED turns on when silence is activated via the Sounder On/Off or via the alarm silence software timers.

See Page 2 for descriptions of Reset, Panel Silence, and Drill functions.

Event Queues



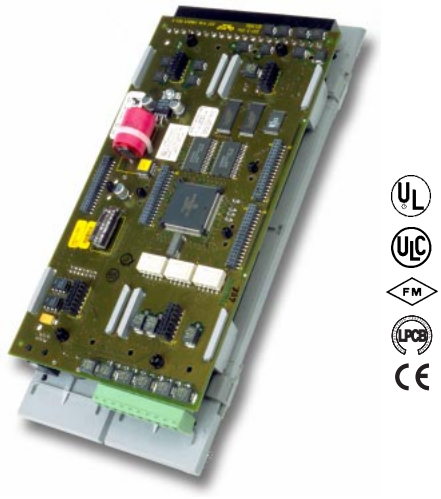
For EN-54 compliance, EST3 configures for remote proprietary system operation. This requires that every event must be acknowledged by viewing them before the internal buzzer will silence. The priority order is Fire, Fault, Disable, Monitor.

Central Processor Unit Module

Model: 3-CPU1, 3-RS485A, 3-RS485B, 3-RS232

Features

- **16 bit processor**
- **Up to 1750 history events**
- **RS-485 local rail communications**
- **Multiplexed audio channels**
- **Network communication RS-485**
- **RS-232 communication card**
- **Form 'C' contacts for: Alarm, Supervisory and Trouble**
- **Low voltage memory write protection**



3-CPU1

Description

The 3-CPU1 is the Central Processing Unit Module monitoring the status of all modules and providing the link for network communications. Although each local rail card contains their own microprocessor, the 3-CPU1 provides all inter-module communication and has the ability to download rail module operating parameters. Upon power up the 3-CPU1 automatically learns all local rail module attributes and locations. Site specific software is loaded into the 3-CPU1 which then downloads data to each local rail module. Firmware upgrades are also done from the 3-CPU1 eliminating the need to unplug chips on rail modules. Internal rail communications is accomplished in a broadcast protocol for fast response.

Mounting must be in the first two local rail spaces. Options for the 3-CPU1 include the addition of an LCD display and User Interface, RS-232 Communication Card, and RS-485 Series Network Communication Cards.

Application

The 3-CPU1 helps make EST3 an extremely powerful and flexible system. As a single node, stand alone system a single 3-CPU1 controls 1 to 19 local rail modules. For larger systems, up to 64 nodes interconnect on a peer-to-peer multi-priority token ring protocol network.

The 3-CPU1 controls all local panel responses to automatic, user initiated, or network reported events. As a network node, it is an equal among peers, there is no master on the network. Multi-priority token ring means that a node with a new alarm has priority on the network. This gives exceptional response times over the network, less than three seconds.

Each 3-CPU1 provides slots at the back for mounting Network, and RS-232, cards. Removable terminal blocks on the 3-CPU1 support connection of network and audio data wiring. On board common relays also terminate at the 3-CPU1 terminals. To aid in trouble shooting and service, status LEDs monitor local rail, network, RS232 and audio data communications.

The **Network Communications** card mounts to the back of the Central Processor Unit. The 3-RS485A card provides a Class A (Style 7) or Class B (Style 4) circuit for network communications signals and two additional Class A (Style 7) circuits for the digitized audio signals. The 3-RS485B card provides a Class B (Style 4) or Class A (Style 7) circuit for network communications signals and a second Class B (Style 4) circuit for the digitized audio signals. Network messages received by the Network Communications card are re-transmitted to the next network node. Re-transmission maximizes the wire run lengths between nodes. With 64 nodes miles of network length is possible. Fail safe mechanisms built into the card direct connect the data input and output ports should the network card or its related Central Processor fail.

The **3-RS232 Communication Card** mounts to the back of the 3-CPU1. The 3-RS232 has two optically isolated RS-232 ports. The ports support connection of a printer and/or an external command center. Entire network downloading from one location (to all 64 nodes) is available through the RS-232 card.

Specifications

Catalog Number	3-CPU1
Agency Listings	UL, ULC, FM, CE, LPCB, EN-54
Mounting	2 - Left most local rail spaces
Terminal Size	18-12 AWG (1.0mm² to 2.5mm²)
Standby Current	70 mA
Alarm Current	80 mA
Contact Ratings	Nonbypassable Alarm, Supervisory and Trouble Form 'C' 1A at 30 Vdc
Data Down Loading	RJ45 Jack
Operating Environment	0°C - 49°C (32°F - 120°F); 93% at 40°C Non-Condensing

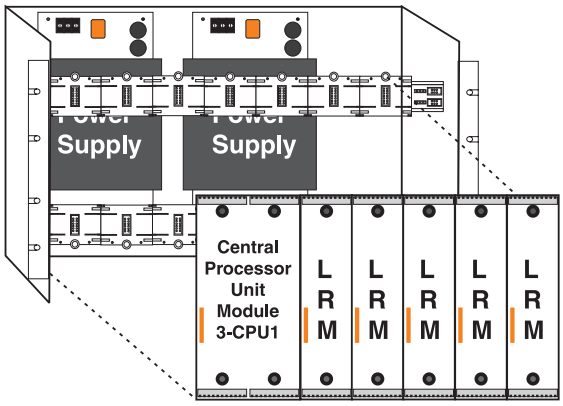
Option Cards

Catalog number	3-RS232	3-RS485A	3-RS485B
Standby Current	48	55	55
Alarm Current	48	55	55
Communication Ports	Two optically isolated RS-232	Three RS-485 Class A (Style 7)	One Class B (Style 4) or Class A (Style 7) network data circuit and one Class B (Style 4) audio data circuit
Agency Listings	UL, ULC, FM, CE, LPCB		
Mounting	Back of 3-CPU1		
Operating Environment	0°C - 49°C (32°F - 120°F); 93% at 40°C Non-Condensing		

Engineering Specification

It must be possible to support a single stand alone node or up to 64 nodes communicating on a peer-to-peer multi-priority token ring protocol network. Network and digitized audio wiring shall be run in a [choose one: Class A (Style 7) or Class B (Style 4)] configuration. Any node on the network with a new alarm must have priority on the network. Network alarm response from alarm input to signal activation must be under 3 seconds. All field wiring must be to removable terminal blocks. Status LEDs must be provided for communications of network, RS-232, audio and internal rail communications. Internal node communication speed must be programmable.

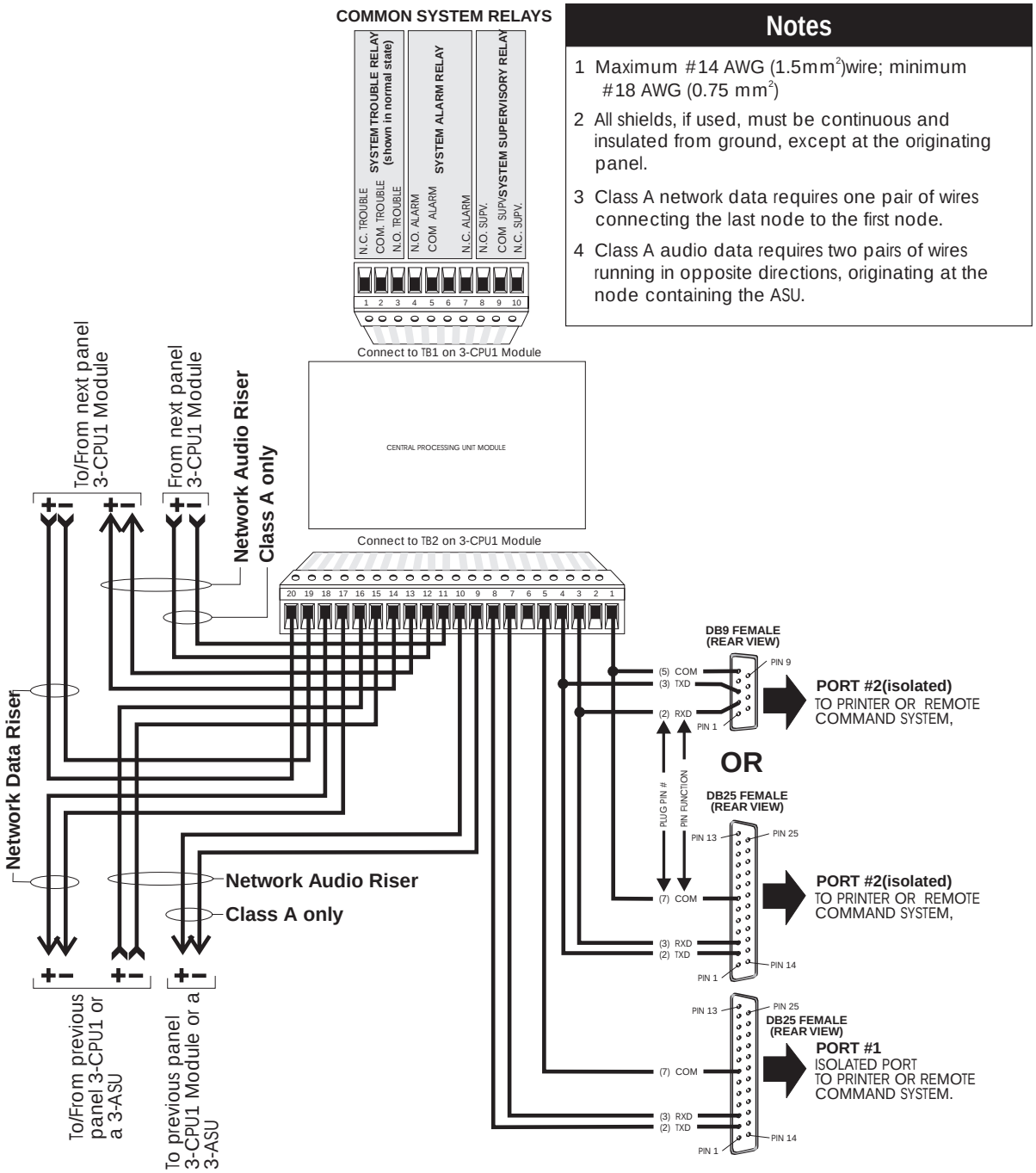
Installation and Mounting



Ordering Information

Catalog Number	Description	Ship Wt. - lb (kg)
3-CPU1	Central Processor Unit Module	0.7lb (0.32kg)
3-RS485A	Network Communications Card, Class A (Style 7)	0.33lb (0.15kg)
3-RS485B	One Class A/B network data circuit and one Class B audio data circuit	0.33lb (0.15kg)
3-RS232	RS-232 Communication Card	0.33lb (0.15kg)

Typical Wiring



Notes

1. Maximum #14 AWG (1.5mm^2)wire; minimum #18 AWG (0.75 mm^2)
2. All shields, if used, must be continuous and insulated from ground, except at the originating panel.
3. Class A network data requires one pair of wires connecting the last node to the first node.
4. Class A audio data requires two pairs of wires running in opposite directions, originating at the node containing the ASU.

Overview

The SIGA-270 and SIGA-278 series Manual Pull Stations are part of GE Security's Signature Series system. The SIGA-270 Fire Alarm Manual Pull Stations feature our very familiar teardrop shape. They are made from die-cast zinc and finished with red epoxy powder-coat paint complemented by aluminum colored stripes and markings. With positive pull-lever operation, one pull on the station handle breaks the glass rod and turns in a positive alarm, ensuring protection plus fool-proof operation. Presignal models (SIGA-270P) are equipped with a general alarm (GA) keyswitch for applications where two stage operation is required. The up-front highly visible glass rod discourages tampering, but is not required for proper operation.

GE Security's double action single stage SIGA-278 station is a contemporary style manual station made from durable red colored lexan. To initiate an alarm, first lift the upper door marked "LIFT THEN PULL HANDLE", then pull the alarm handle.

Standard Features

Note: *Some features described here may not be supported by all control systems. Check your control panel's Installation and Operation Guide for details.*

- **Traditional familiar appearance**
  SIGA-270 models feature our familiar teardrop design with simple positive pull action and sturdy die-cast metal body.
- **One stage (GA), two stage (pre-signal), and double action models**
  SIGA-270 models are available for one or two stage alarm systems. The single stage double action SIGA-278 features a rugged Lexan housing with keyed reset mechanism.
- **Break glass operation**
  An up-front visible glass rod on the SIGA-270 discourages tampering.
- **Intelligent device c/w integral microprocessor**
  All decisions are made at the station allowing lower communication speed while substantially improving control panel response time. Less sensitive to line noise and loop wiring properties; twisted or shielded wire is not required.
- **Non-volatile memory**
  Permanently stores serial number, type of device, and job number. Automatically updates historic information including hours of operation, last maintenance date, number of alarms and troubles, and time and date of last alarm.
- **Automatic device mapping**
  Each station transmits wiring information to the loop controller regarding its location with respect to other devices on the circuit.
- **Electronic addressing**
  Permanently stores programmable address; there are no switches or dials to set. Addresses are downloaded from a PC, or the SIGA-PRO Signature Program/Service Tool.
- **Stand-alone operation**
  The station inputs an alarm even if the loop controller's polling interrogation stops.
- **Diagnostic LEDs**
  Status LEDs; flashing GREEN shows normal polling; flashing RED shows alarm state.
- **Designed for high ambient temperature operation**
  Install in ambient temperatures up to 120 °F (49 °C).

Manual Pull Stations

SIGA-270, SIGA-270P, SIGA-278

SIGA-278

SIGA-270 SERIES

MEA

Patented

Application

The operating characteristics of the fire alarm stations are determined by their sub-type code or "Personality Code". NORMALLY-OPEN ALARM - LATCHING (Pesonality Code 1**)** is assigned by the factory; no user configuration is required. The device is configured for Class B IDC operation. An ALARM signal is sent to the loop controller when the station's pull lever is operated. The alarm condition is latched at the station.

Compatibility

Signature Series manual stations are compatible only with GE Security's Signature Loop Controller.

Warnings & Cautions

This device will not operate without electrical power. As fires frequently cause power interruption, we suggest you discuss further safeguards with your local fire protection specialist.

Testing & Maintenance

To test (or reset) the station simply open the station and operate the exposed switch. The SIGA-270 series are opened with a tool; the SIGA-278 requires the key which is supplied with that station.

The station's automatic self-diagnosis identifies when it is defective and causes a trouble message. The user-friendly maintenance program shows the current state of each Signature series device and other pertinent messages. Single devices may be deactivated temporarily, from the control panel. Availability of maintenance features is dependent on the fire alarm system used.

Scheduled maintenance (Regular or Selected) for proper system operation should be planned to meet the requirements of the Authority Having Jurisdiction (AHJ). Refer to current NFPA 72 and ULC CAN/ULC 536 standards.

Typical Wiring

The fire alarm station's terminal block accepts #18 AWG (0.75mm^2) to #12 AWG (2.5mm^2) wire sizes. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.

Wiring Notes

1. Refer to Signature Loop Controller manual for maximum wire distance.
2. All wiring is power limited and supervised.

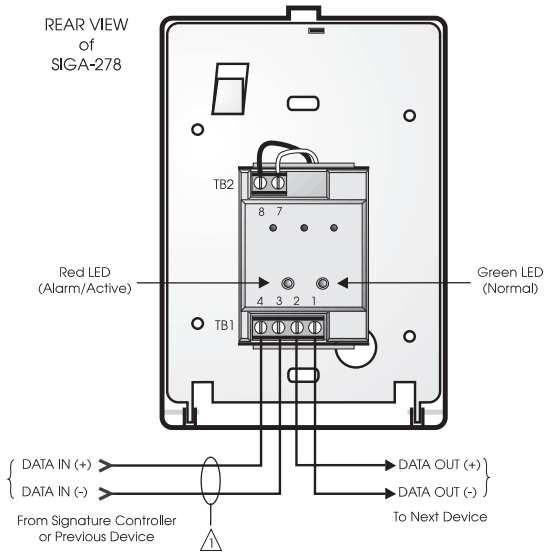


Figure 4. Single Stage Systems

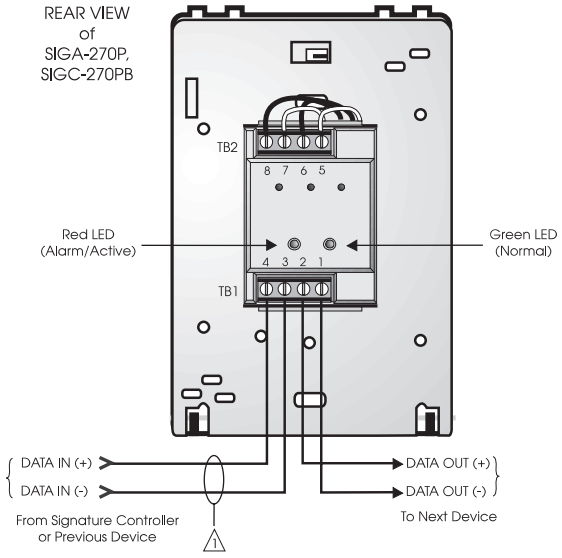


Figure 5. Two Stage Systems

Installation

Single-stage Signature Series fire alarm manual pull stations mount to North American 2½ inch (64 mm) deep 1-gang boxes.

Two stage presignal (270P) models require 1½ inch (38 mm) deep 4-inch square boxes with 1-gang, ½-inch raised covers. Openings must be angular. *Rounded openings are not acceptable.* Recommended box: Steel City Model 52-C-13; in Canada, use Iberville Model CI-52-C-49-1/2.

All models include terminals are suited for #12 to #18 AWG (2.5 mm^2 to 0.75 mm^2) wire size. GE Security recommends that these fire alarm stations be installed according to latest recognized edition of national and local fire alarm codes.

Electronic Addressing: The loop controller electronically addresses each manual station, saving valuable time during system commissioning. Setting complicated switches or dials is not required. Each station has its own unique serial number stored in its on-board memory. The loop controller identifies each device on the loop and assigns a "soft" address to each serial number. If desired, the stations can be addressed using the SIGA-PRO Signature Program/Service Tool.

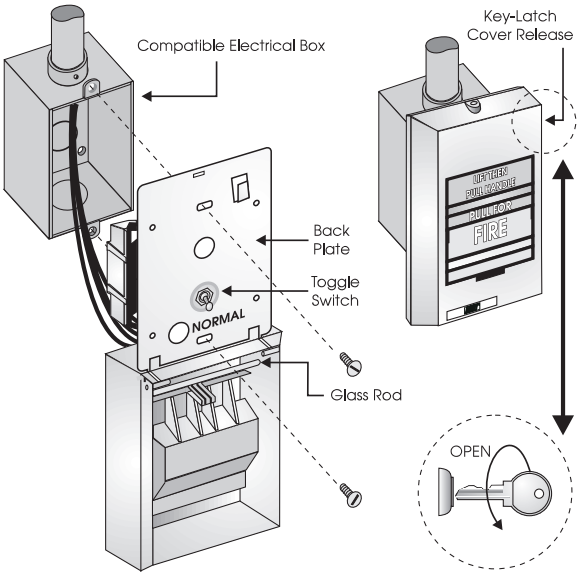


Figure 1. SIGA-278 installation

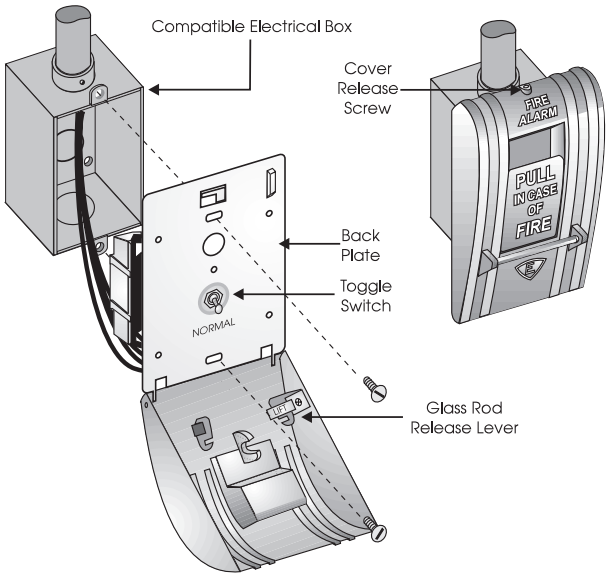


Figure 2. SIGA-270, SIGC-270F, SIGC-270B installation

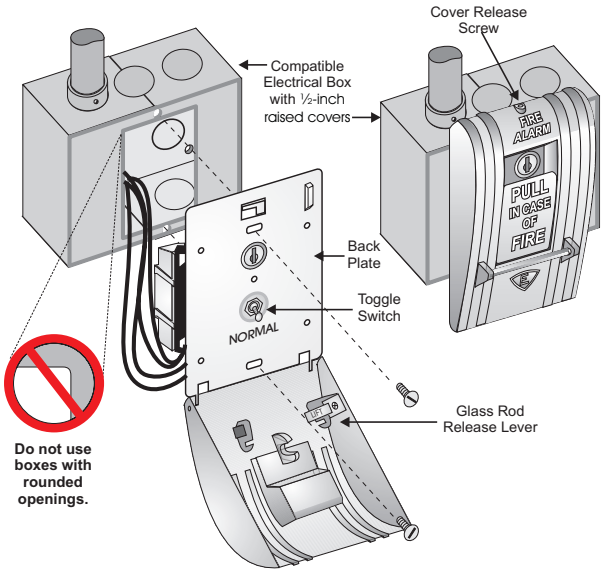


Figure 3. SIGA-270P, SIGC-270PB installation

U.S.
T 888-378-2329
F 866-503-3996

Canada
T 519 376 2430
F 519 376 7258

Asia
T 852 2907 8108
F 852 2142 5063

Australia
T 61 3 9259 4700
F 61 3 9259 4799

Europe
T 32 2 725 11 20
F 32 2 721 86 13

Latin America
T 305 593 4301
F 305 593 4300

www.gesecurity.com

Specifications

Catalog Number	SIGA-270, SIGC-270F, SIGC-270B	SIGA-270P, SIGC-270PB	SIGA-278
Description	Single Action - One Stage	Single Action -Two Stage (Presignal)	Double Action - One Stage
Addressing Requirements	Uses 1 Module Address	Uses 2 Module Addresses	Uses 1 Module Address
Operating Current	Standby = 250µA Activated = 400µA	Standby = 396µA Activated = 680µA	Standby = 250µA Activated = 400µA
Construction & Finish	Diecast Zinc - Red Epoxy with aluminum markings		Lexan - Red with white markings
Type Code	Factory Set		
Operating Voltage	15.2 to 19.95 Vdc (19 Vdc nominal)		
Storage and Operating Environment	Operating Temperature: 32°F to 120°F (0°C to 49°C) Storage Temperature: -4°F to 140°F (-20°C to 60°C) Humidity: 0 to 93% RH		
LED Operation	On-board Green LED - Flashes when polled On-board Red LED - Flashes w hen in alarm Both LEDs - Glow steady when in alarm (stand-alone)		
Compatibility	Use With: Signature Loop Controller		
Agency Listings	UL, ULC (note 1), MEA, CSFM		

Note: *SIGC-270F, SIGC-270B and SIGC-270PB are ULC listed only. Suffix "F" indicates French markings. Suffix "B" indicates English/French biling ual markings.*

Ordering Information

Catalog Number	Description	Ship Wt. lbs (kg)
SIGA-270	One Stage Fire Alarm Station, English Markings - UL/ULC Listed	1 (0.5)
SIGC-270F	One Stage Fire Alarm Station, French Markings - ULC Listed	
SIGC-270B	One Stage Fire Alarm Station, French/English Markings - ULC Listed	
SIGA-270P	Two Stage (Presignal) Fire Alarm Station, English Markings - UL/ULC Listed	
SIGC-270PB	Two Stage (Presignal) Fire Alarm Station, French/English Markings - ULC Listed	
SIGA-278	Double Action (One Stage) Fire Alarm Station, English Markings - UL/ULC Listed	

Accessories		
32997	GA Key w/Tag - for pre-signal station (CANADA ONLY)	0.1 (.05)
276-K2	GA Key - for pre-signal station (USA ONLY)	
27165	12 Glass Rods - for SIGA-270 series (CANADA ONLY)	
270-GLR	20 Glass Rods - for SIGA-270 series (USA ONLY)	
276-GLR	20 Glass Rods - for SIGA-278 series	
276B-RSB	Surface Mount Box, Red - for SIGA pull stations	1 (0.6)

imagination at work

EST™
Life Safety & Communications

Genesis Speakers and Strobes

Genesis G4 Series

MEA
FM
PENDING
Patents pending

Overview

The Genesis line of life safety and mass notification/emergency communications (ECS/MNS) signals are the smallest, most compact audible-visible emergency signaling devices in the world. Protruding no more than one inch from the wall, Genesis speakers and speaker-strobes blend with any decor.

Life safety appliances feature textured housings in architecturally neutral white or traditional life safety red.

ECS/MNS appliances offer emergency signaling with clear or amber lenses, white housings, and optional ALERT housing labels. They are ideal for applications that require differentiation between life safety and mass notification signals.

Thanks to patented breakthrough technology, Genesis strobes do not require bulky specular reflectors. Instead, an exclusive design channels and conditions light to produce a highly controllable distribution pattern.

Speaker-strobes feature selectable candela output with a conveniently-located switch on the bottom of the device. The candela setting remains clearly visible even after final installation.

All Genesis speakers include a DC blocking capacitor to allow electrical supervision of the audio distribution circuit. The speaker with its sealed back construction provides extra durability and improved audibility.

Standard Features

- **Unique low-profile design**
  - The most compact UL/ULC listed speaker-strobe available
  - Ultra-slim, protrudes a mere one inch from the wall
  - Attractive appearance, no visible mounting screws
- **Field configurable – no need to remove the device!**
  - ¼, ½, 1, or 2 watt operation and selectable candela output with convenient switches that remain visible even after the unit is installed
- **ECS/MNS models available**
- **Unparalleled performance**
  - loud 90 dBA output ensures clear, crisp audio
  - Exclusive FullLight strobe technology produces the industry's most even light distribution
  - Precision timing electronics meet tough new synchronizing standards for strobes when used with compatibile modules
  - Optional field-configurable temporal strobe output
  - 25 Vrms and 70 Vrms models available, all supplied with a DC blocking capacitor for audio circuit supervision
- **Easy to install**
  - Fits all standard 4" square electrical boxes with plenty of room behind the signal for extra wire – no extension ring or trim plate needed
  - #18 - #12 AWG terminals – ideal for long runs or using existing wiring

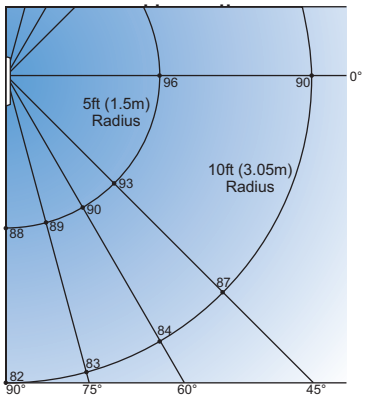
DATA SHEET 85001-0549
Not to be used for installation purposes. Issue 10

Speaker Application

The suggested sound pressure level for each signaling zone used with alert or alarm signals is a minimum of 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds, whichever is greater. This is measured 5 feet (1.5 m) above the floor.

Doubling the distance from the signal to the ear will theoretically cause a 6dB reduction in the received sound pressure level. The actual effect depends on the acoustic properties of materials in the space. Doubling the power output of a device (e.g.: a speaker from 1W to 2W) will increase the sound pressure level by 3dBA.

Typical Sound Output Distribution dBA Measured in anechoic chamber



Genesis Series Cone Speaker/strobe

Strobe Application

Genesis clear-lensed strobes are UL 1971-listed for use indoors as wall-mounted public-mode notification appliances for the hearing impaired. Prevailing codes require strobes to be used where ambient noise conditions exceed specified levels, where occupants use hearing protection, and in areas of public accommodation. UL 1638-listed colored-lensed strobe lights are available for ECS/MNS applications. Consult with your Authority Having Jurisdiction for details.

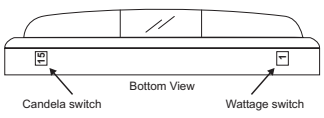
All Genesis strobes meet UL synchronization requirements (within 10 milliseconds over a two-hour period) when used with a synchronization source. Synchronization is important in order to avoid epileptic sensitivity.

Field Configuration

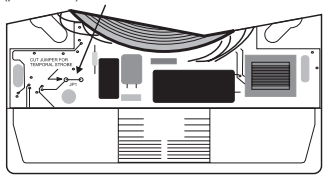
Genesis speakers may be set for ¼, ½, 1, or 2 watt operation. The wattage setting is visible through a small window on the bottom of the device and is changed by simply sliding the switch until the desired setting appears in the window. The speaker does not have to be removed to change the wattage.

Genesis speaker-strobes feature selectable candela output. The output setting is visible through a small window on the bottom of the device and is changed by simply sliding the switch until the desired setting appears in the window. The speaker-strobe does not have to be removed to change the output.

Use the Candela Switch and the Wattage switch to set desired operation.



To change strobe to temporal (private mode) cut JP1

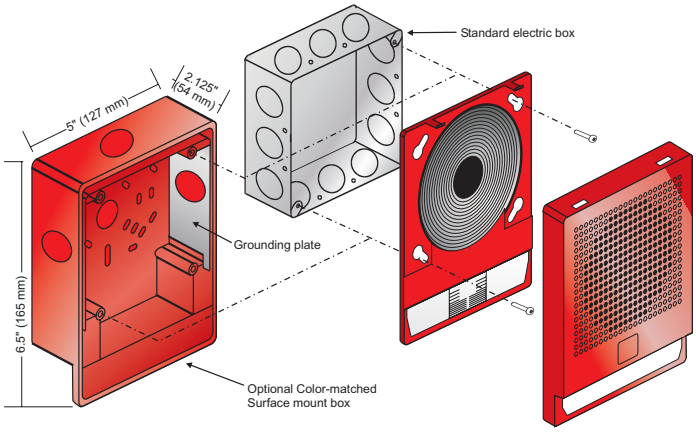


Genesis speaker-strobes may also be configured for temporal flash. This battery-saving feature is intended for private mode signaling only. To set the device for temporal flash, snip the circuit board as shown in the Jumper Locations diagram above.

Installation and Mounting

All models are intended for indoor wall mounted applications only. Speakers and speaker-strobes are flush mounted to a North-American 4" square electrical box, 2⅛" (54 mm) deep or a European 100 mm square box. Signals may be surface mounted to a Genesis surface-mount box (see ordering information for details).

Two tabs at the top of the signal unlock the cover to facilitate mounting. The shallow depth of Genesis devices leaves room behind the signal for extra wiring. Once installed with the cover in place, no mounting screws are visible.



Edwards recommends that these speaker-strobes always be installed in accordance with the latest recognized edition of national and local codes. Refer to installation sheet for mounting height information.

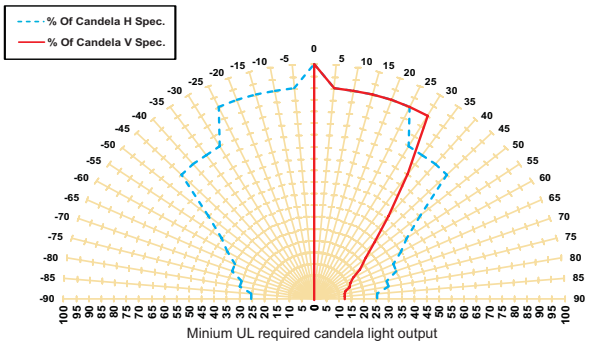
WARNING: These devices will not operate without electrical power. As fires frequently cause power interruptions, we suggest you discuss further safeguards with your local fire protection specialist.

ECS/MNS Applications

Genesis ECS/MNS appliances bring the same high-performance life safety features and unobtrusive design to mass notification applications. Standard models are available with clear or amber lenses and optional ALERT housing labels, they are ideal for applications that require differentiation between life safety and mass notification alerts. Appliances with red, green or blue lenses are available. Contact Edwards Customer Service for details.

Light output

Per cent of UL rating versus angle



Minium UL required candela light output

UL name plate maximum operating current (RMS-mA)

Cd rating	"15" or "A"	"30" or "B"	"75" or "C"	"110" or "D"
16 Vdc	96	130	239	294
16 Vfwr	120	169	329	375

Typical current, milliamps - average (RMS)

Cd rating	"15" or "A"	"30" or "B"	"75" or "C"	"110" or "D"
20 Vdc	65 (78)	93 (101)	182 (188)	238 (245)
24 Vdc	55 (65)	78 (86)	153 (159)	196 (203)
31 Vdc	45 (53)	63 (69)	120 (124)	151 (157)
20 Vfwr	56 (106)	79 (147)	147 (264)	197 (342)
24 Vfwr	50 (95)	68 (130)	121 (225)	155 (283)
27 Vfwr	44 (84)	60 (115)	107 (200)	137 (251)

Light output switch settings for UL 1971 listed models are selectable by numeric candela value. ECS/MNS appliances are selectable by A, B, C, or D designations.

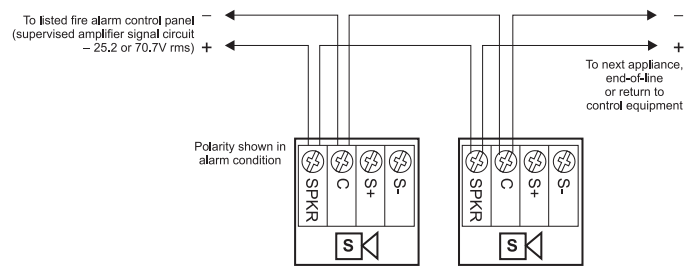
Lens Color	Rating	Switch Position A	Switch Position B	Switch Position C	Switch Position D
Amber	UL 1638	110 cd	75 cd	30 cd	15 cd
Amber	UL 1971*	88 cd	60 cd	24 cd	12 cd
Clear	UL 1971	110 cd	75 cd	30 cd	15 cd

** Equivalent Rating*

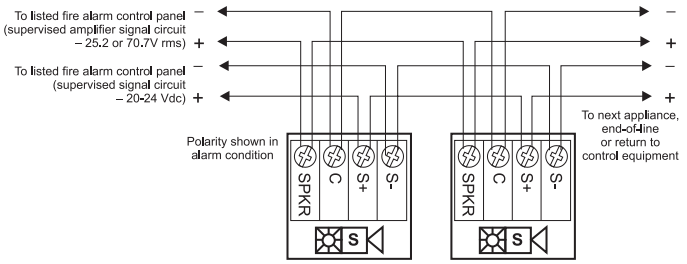
Wiring

Field wiring is connected to Genesis signals with terminals that accommodate #18 to #12 AWG (0.75 mm² to 2.5 mm²) wiring.

Speaker-only Wiriing



Speaker-Strobe Wiring



Specifications

Genesis Speakers and Speaker-Strobes	
Housing	Red or white textured UV stabilized, color impregnated engineered plastic.
Dimensions	Height: 6.5" (165 mm). Width: 5" (127 mm). Depth to wall: 1" (25 mm).
Mounting (indoor wall mount only)	Flush: North-American 4" square box, 2 1/8" (54 mm) deep. Surface: model G4B (white) or G4RB (red) surface mount box.
Wire Connections	Screw terminals: separate polarized inputs for speaker and strobe, #18 to #12 AWG (0.75 mm² to 2.5 mm²) wire size
Operating environment	32-120° F (0-49° C) ambient temperature; 0-93% relative humidity.
Agency Listings	UL 1971, UL 1638, UL 1480, ULC S526, ULC S541, CSFM, MEA (FM pending) (All models comply with ADA Code of Federal Regulation Chapter 28 Part 36 Final Rule.)

Speakers	
Input/Operating Volts	25 VRMS or 70 VRMS. See ordering information.
Speaker Taps/Output*	2 W = 89 dBA; 1 W = 86 dBA; ½ W = 83 dBA; ¼ W = 80 dBA
Speaker Cone	Speaker frequency response: 250 to 5,000 Hz. Optimized for voice intelligibility. 4-inch (102mm) mylar cone, sealed back construction.

Strobes	
Clear Strobe Output Rating	UL 1971, ULC S526: selectable 15 cd, 30 cd, 75 cd, or 110 cd output UL 1971: 15 cd (fixed 15/75 cd models) UL 1638, ULCS526: 75 cd (fixed 15/75 cd models)
Amber Strobe Output Rating	UL 1638: 13 (D), 26 (C), 65 (B), 95 (A)
Strobe Operating Voltage	16 - 33 Vdc Regulated, 16-33 V Full wave rectified (UL Voltage Designations "Regulated 24" and "24 fwr")
Strobe Flash Rate	One flash per second.
Strobe Flash Synchronization	All strobes: one flash per second (fps) within 200 milliseconds over 30 minutes on common circuit. All strobes: Synchronization source required to comply with UL 1971 synchronization standard. Temporal setting (private mode only): synchronized to temporal output on the same circuit.
Synchronization Sources	SIGA-CC1S, SIGA-MCC1S, SIGA-CC2A, SIGA-MCC2A, G1M-RM BPS6A, BPS10A, APS6A, APS10A, iO64, iO500, Fireshield Plus 3, 5 and 10 zone.
Strobe Lens Material	Polycarbonate

** Measured in reverberant room using 400-4,000 Hz band limited pink noise per UL 1480.*

EDWARDS
A UTC Fire & Security Company

Detection & alarm since 1872

U.S.
T 888 378 2329
F 866 503 3996

Canada
Chubb Edwards
T 519 376 2430
F 519 376 7258

Southeast Asia
T : +65 6391 9300
F : +65 6391 9306

India
T : +91 80 4344 2000
F : +91 80 4344 2050

Australia
T +61 3 9239 1200
F +61 3 9239 1299

Europe
T +32 2 725 11 20
F +32 2 721 86 13

Latin America
T 305 593 4301
F 305 593 4300

utcfireandsecurity.com

Ordering Information

Light output switch settings for UL 1971 listed models are selectable by numeric candela value.
ECS/MNS appliances are selectable by A, B, C, or D designations.
All speaker-strobes include field-selectable ¼, ½, 1, or 2 watt taps

Model	Housing	Marking	Lens	Strobe	Speaker	Ship Wt.
Life safety Appliances (c/w running man icon screen printed on housing)						
G4-S2	White	None	Clear	Selectable 15, 30, 75, or 110 cd	25 Volt	1.5 lbs. (0.68 kg)
G4R-S2	Red	None				
G4F-S2	White	FIRE				
G4RF-S2	Red	FIRE				
G4-S2VM	White	None				
G4R-S2VM	Red	None				
G4F-S2VM	White	FIRE				
G4RF-S2VM	Red	FIRE				
G4-S7	White	None		Selectable 15, 30, 75, or 110 cd	70 Volt	
G4R-S7	Red	None				
G4F-S7	White	FIRE				
G4RF-S7	Red	FIRE				
G4-S7VM	White	None				
G4R-S7VM	Red	None				
G4F-S7VM	White	FIRE				
G4RF-S7VM	Red	FIRE				
G4F-S7V1575	White	FIRE		15/75 cd[1]		
G4RF-S7V1575	Red	FIRE				
ECS/MNS Appliances (no running man icon on housing)						
G4WA-S2VMA	White	Alert	Amber	Selectable A, B, C or D	25 Volt	1.5 lbs. (0.68 kg)
G4WA-S2VMC		Alert	Clear			
G4WN-S2VMA		None	Amber			
G4WN-S2VMC		None	Clear			
G4WA-S2		Alert	None	Speaker only		
G4WN-S2		None	None			
G4WA-S7VMA		Alert	Amber	Selectable A, B, C or D	70 Volt	
G4WA-S7VMC		Alert	Clear			
G4WN-S7VMA		None	Amber			
G4WN-S7VMC		None	Clear			
G4WA-S7		Alert	None	Speaker only		
G4WN-S7		None	None			

Accessories

G1M-RM	Synchronization Output Module (1-gang)	0.2 (0.1)
SIGA-CC1S	Intelligent Synchronization Output Module (2-gang)	0.5 (0.23)
SIGA-MCC1S	Synchronization Output Module (Plug-in UIO)	0.18 (0.08)
G4B	Surface mount box, white	0.7 (0.32)
G4RB	Surface mount box, red	0.7 (0.32)

Overview

The Remote Booster Power Supply is a self-contained 24 Vdc power supply designed to augment fire alarm audible and visual power requirements as well as provide power for auxiliary, access control and security applications. The booster contains all of the necessary circuits to monitor and charge batteries, control and supervise four Class B or two Class A NAC circuits and monitor two controlling inputs from external sources.

Simple switch selection provides a wide variety of operational configurations. Each remote booster power supply is supplied with its own enclosure providing ample space for additional interface modules and battery compartment.

The Remote Booster Power Supply is available in either a 6.5 or 10 amp version @ 24 Vdc.

Standard Features

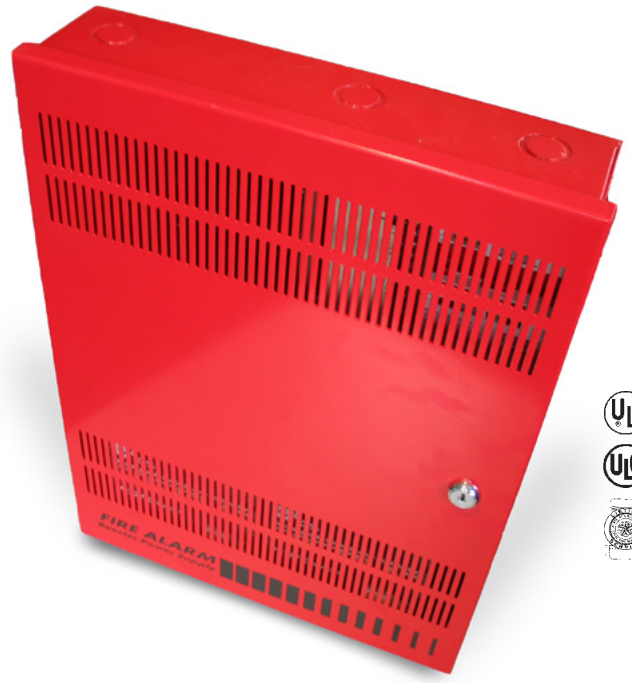
- Available in 10 amp and 6.5 amp versions.
- Includes four independent 3 amp NACs – each configurable as auxiliary outputs.
- Configurable signal rates.
- Field selectable input-to-output correlation.
- Extends power available to Notification Appliance Circuits (NACs).
- Provides strobe synchronization.
- Use as auxiliary Power Supply.
- Extensive UL Listings
  (Listed accessory under the following standards)

Standard	CCN	Description
UL864 9th edition	UOXX	Fire Alarm Systems
UL636	ANET, UEHX7	Holdup Alarm Units and Systems
UL609	AOTX, AOTX7	Local Burglar Alarm Units and Systems
UL294	ALVY, UEHX7	Access Control Systems
UL365	APAW, APAW7	Police Station Connected Burglar Alarm Units and Systems
ULC-S527	UOXXC	Control Units, Fire Alarm (Canada)
ULC-S303	AOTX7	Local Burglar Alarm Units and Systems (Canada)
ULC-S304	AMCX7	Central and Monitoring Station Burglar Alarm Units (Canada)
C22.2 No. 205		Signaling Equipment (Canada)
UL1076	APOU, APOU7	Proprietary Burglar Alarm System Units
UL1610	AMCX	Central Station Alarm Unit

- Two inputs allow activation by Signature Series modules or existing NACs.
- NACs configure for either four Class B or two Class A circuits.
- 110 Vac and 230 Vac versions
- On-board status LEDs for easy recognition of wiring faults.
- Supports up to 24 Amp hour batteries for fire and security applications, up to 65 Amp hour for access control applications.

Remote Booster Power Supplies

BPS6A, BPS10A



Application

The Remote Booster Power Supply provides additional power for audible and visual devices helping remove system capacity or site application constraints. The booster may also be used to power auxiliary, access control and security devices, in addition to fire devices.

Fault conditions detected by the BPS will open the main panel's NAC. This initiates a trouble condition and eliminates the need to wire a separate trouble contact back to the control panel. During alarm condition, detected faults are overridden and the main panel's default configuration is continuous 24 Vdc on all NACs typically used to drive visual devices. On board trouble contact is supplied for applications requiring trouble contact monitoring.

The booster power supply provides the capability to maximize available power by being able to supply power for multiple services including Access Control, Security and Fire. For security applications, space is provided to mount a tamper switch in the cabinet. When used for Fire Alarm notification with Genesis Notification appliances, the booster provides the ability to synchronize strobes as well as horn signals. The booster flexibility allows synchronization with upstream devices, or, the booster may be used to synchronize downstream devices, as well as other boosters and their connected devices. Up to 10 boosters deep may be configured while maintaining strobe synchronization.

BPS notification appliance circuits easily configure for either of two signaling rates: 3-3-3 temporal or continuous. California rate is also available on certain models. This makes the BPS ideal for applications requiring signaling rates not available from the main panel. It also allows independent setup of a notification appliance circuit without interfering with the main panel and its initiating circuits.

In addition to the generated signal rates, the BPS can also be configured to follow the signal rate of the main panel's notification appliance circuit. This allows seamless expansion of existing NACs.

The BPS includes seven on-board LED indicators: one for each resident NAC; one for battery supervision; one for ground fault; and, one for ac power. The trouble contact has a sixteen second delay when an ac power failure or brownout condition is detected. This reduces the reporting of troubles during short duration ac brownouts.

NAC configuration options include: ac power fail delay (16 seconds or 6 hours); sensing input to NAC output correlations; and, auxiliary outputs. All NACs are configurable as auxiliary outputs. Auxiliary outputs can be always on, or off after 30 seconds without ac power. As auxiliary output, the booster may power access control and security devices. Should an overcurrent occur, the booster automatically opens the circuit. The booster automatically restores the circuit when the overcurrent is removed. Jumpers configure the BPS for Class A or Class B wiring.

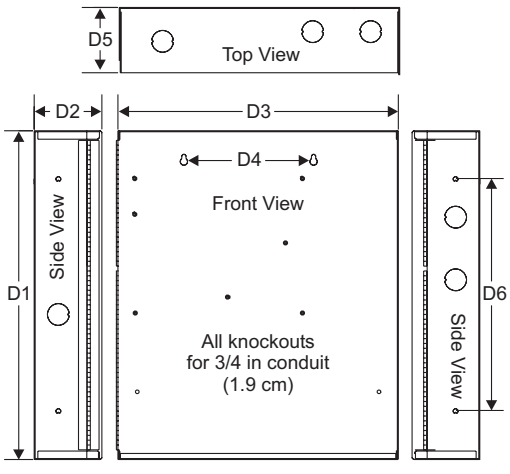
Engineering Specification

Supply where needed GE Security BPS series Booster Power Supplies as an extension of Notification Appliance Circuits. The extension shall be in the form of a stand alone booster power supply. The supply must incorporate its own standby batteries. Batteries must be sized for <24>, <60> hours of standby followed by <5>, <30> minutes of alarm. It must be possible to support up to 24 Amp hour batteries.

The booster supply must incorporate four independent supervised Notification Appliance Circuits. It shall be possible to configure the NACs to follow the main panel's NAC or activate from intelligent Signature Series modules. The booster NACs must be configurable to operate independently at any one of the following rates: continuous, California Rate, or 3-3-3 temporal. Fault conditions on the booster shall not impede alarm activation of host NAC circuits.

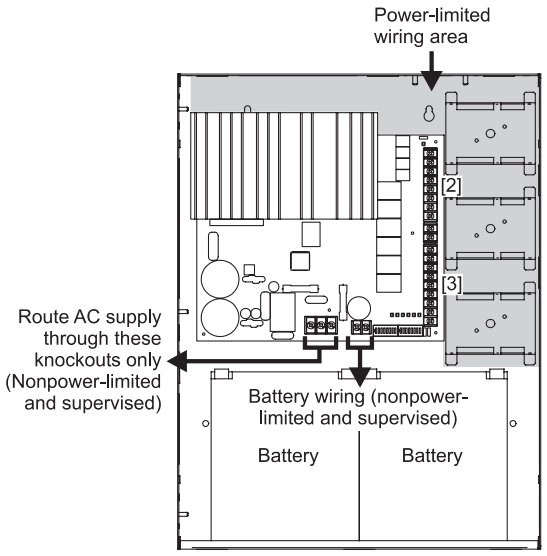
The booster must be able to provide concurrent power for Notification devices, Security devices, Access Control equipment and Auxiliary devices such as door holders. The BPS must provide the ability to synchronize Genesis series strobes and horns.

Dimensions



D1	D2	D3	D4	D5	D6
17.0 in (43.2 cm)	3.5 in (8.9 cm)	13.0 in (33.0 cm)	6.5 in (16.5 cm)	3.375 in (8.6 cm)	12.0 in (30.4 cm)

Wire routing



Notes

1. Maintain 1/4-inch (6 mm) spacing between power-limited and non-power-limited wiring or use type FPL, FPLR, or FPLP cable per NEC.

[2] Power-limited and supervised when not configured as auxiliary power. Non-supervised when configured as auxiliary power.

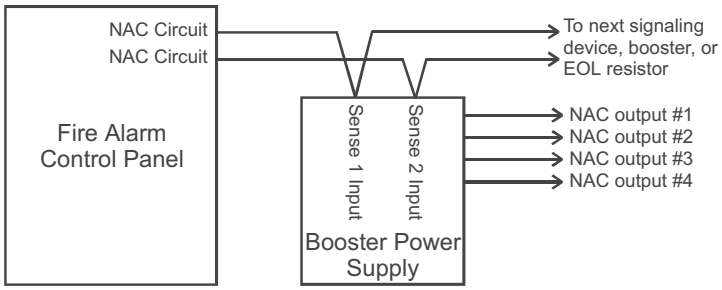
[3] Source must be power-limited. Source determines supervision.

4. When using larger batteries, make sure to position the battery terminals towards the door.

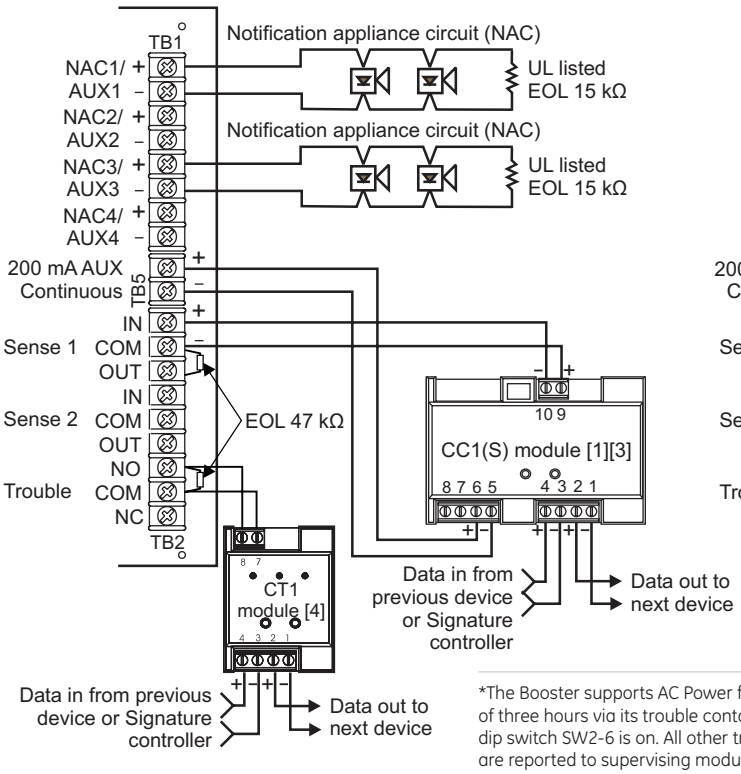
Typical Wiring

Single or castcaded booster anywhere on a notification appliance circuit

Existing NAC end-of-line resistors are not required to be installed at the booster's terminals. This allows multiple boosters to be driven from a single NAC circuit without the need for special configurations.

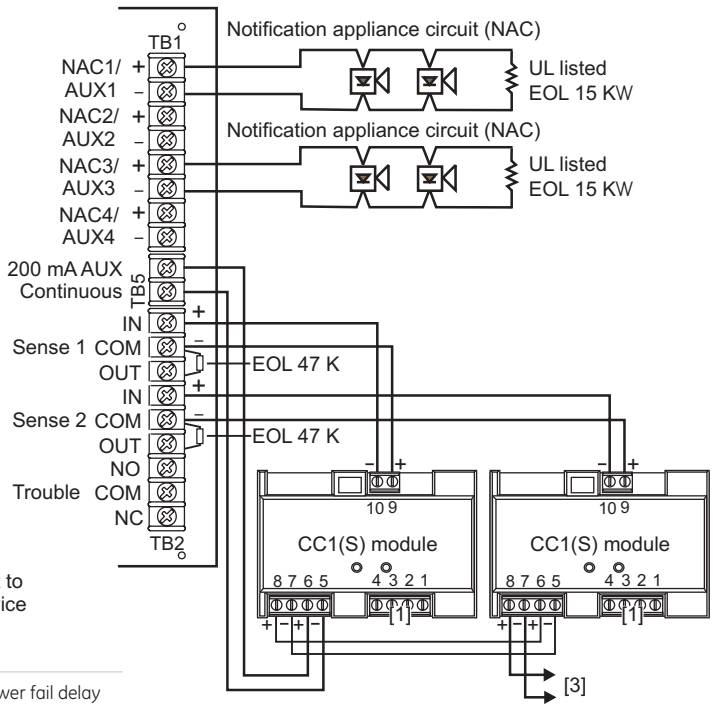


Configuring the Booster for AC Power Fail delay operation*

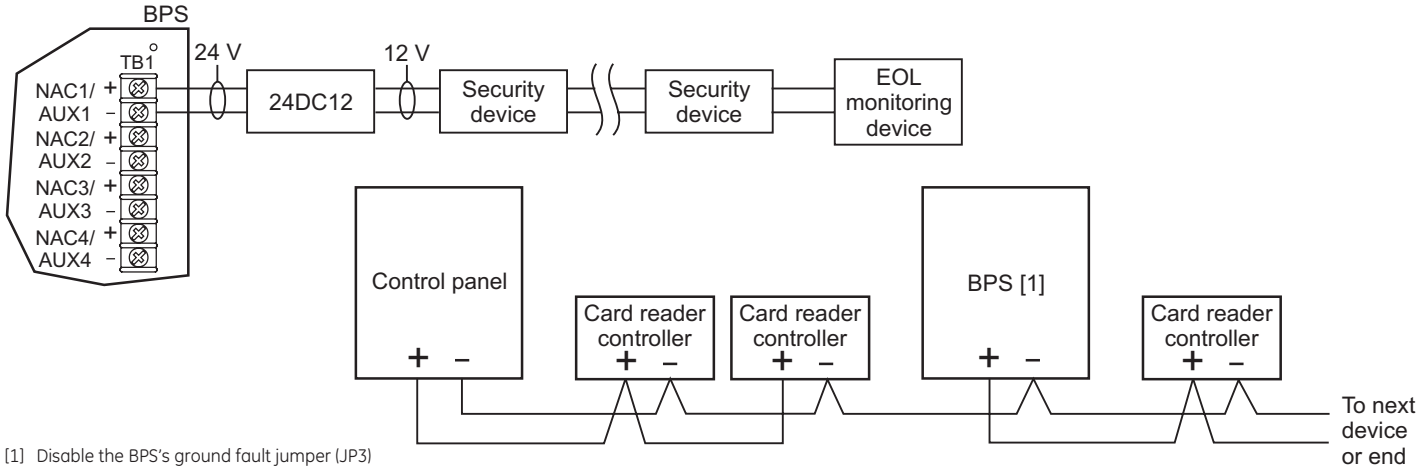


*The Booster supports AC Power fail delay of three hours via its trouble contact when dip switch SW2-6 is on. All other troubles are reported to supervising module or panel without delay via Sense inputs.

Multiple CC1(S) modules using the BPS's sense inputs



Security and access



[1] Disable the BPS's ground fault jumper (JP3)

GE
Security

U.S.
T 888-378-2329
F 866-503-3996

Canada
T 519 376 2430
F 519 376 7258

Asia
T 852 2907 8108
F 852 2142 5063

Australia
T 61 3 9259 4700
F 61 3 9259 4799

Europe
T 32 2 725 11 20
F 32 2 721 86 13

Latin America
T 305 593 4301
F 305 593 4300

www.gesecurity.com/est

Specifications

Model	6.5 amp Booster	10 amp Booster
AC Line Voltage	120VAC or 220-240VAC 50/60Hz 250 watts	120VAC or 220-240VAC 50/60Hz 375 watts
Notification Appliance Circuit Ratings	3.0A max. per circuit @ 24Vdc nominal 6.5A max total all NACs	3.0A max. per circuit @ 24Vdc nominal 10A max total all NACs
Trouble Relay	2 Amps @ 30Vdc	
Auxiliary Outputs	Four configurable outputs replace NACs 1, 2, 3 or 4. as auxiliary outputs and 200 mA dedicated auxiliary. (See note 2.)	
Input Current (from an existing NAC)	3mA @ 12Vdc, 6mA @ 24Vdc	
Booster Internal Supervisory Current	70mA	
Signature Mounting Space	Accomodates three two-gang modules.	
Maximum Battery Size	10 Amp Hours (2 of 12V10A) in cabinet up to 24 Amp hours with external battery cabinet for fire and security applications; up to 65 Amp hours for access control applications in external battery box.	
Terminal Wire Gauge	18-12 AWG	
Relative Humidity	0 to 93% non condensing @ 32°C	
Temperature Rating	32° to 120°F (0° to 49°C)	
NAC Wiring Styles	Class A or Class B	
Output Signal Rates	Continuous, California rate, 3-3-3 temporal, or follow installed panel's NAC. (See note 1.)	
Ground Fault Detection	Enable or Disable via jumper	
Agency Listings	UL, ULC, CSFM	

1. Model BPS*CAA provides selection for California rate, in place of temporal.
2. Maximum of 8 Amps can be used for auxiliary output.

Ordering Information

Catalog Number	Description	Shipping Wt. lb (kg)
BPS6A	6.5 Amp Booster Power Supply	13 (5.9)
BPS6AC	6.5 Amp Booster Power Supply (ULC)	13 (5.9)
BPS6A/230	6.5 Amp Booster Power Supply (220V)	13 (5.9)
BPS6CAA	6.5 Amp Booster Power Supply with California rate	13 (5.9)
BPS10A	10 Amp Booster Power Supply	13 (5.9)
BPS10AC	10 Amp Booster Power Supply (ULC)	13 (5.9)
BPS10A/230	10 Amp Booster Power Supply (220V)	13 (5.9)
BPS10CAA	10 Amp Booster Power Supply with California rate	13 (5.9)

Related Equipment		
12V6A5	7.2 Amp Hour Battery, two required	3.4 (1.6)
12V10A	10 Amp Hour Battery, two required	9.5 (4.3)
3-TAMP	Tamper switch	
BC-1	Battery Cabinet (up to 2 - 40 Amp Hour Batteries)	58 (26.4)
BC-2	Battery Cabinet (up to 2 - 17 Amp Hour Batteries)	19 (8.6)
12V17A	18 Amp Hour Battery, two required (see note 1)	13 (5.9)
12V24A	24 Amp Hour Battery, two required (see note 1)	20 (9.07)
12V40A	40 Amp Hour Battery, two required (see notes 1, 2)	32 (14.5)
12V50A	50 Amp Hour Battery, two required (see notes 1, 2)	40 (18.14)
12V65A	65 Amp Hour Battery, two required (see notes 1, 2)	49 (22.2)

1. Requires installation of separate battery cabinet.
2. BPS supports batteries greater than 24 Amp hours for access control applications only.

imagination at work

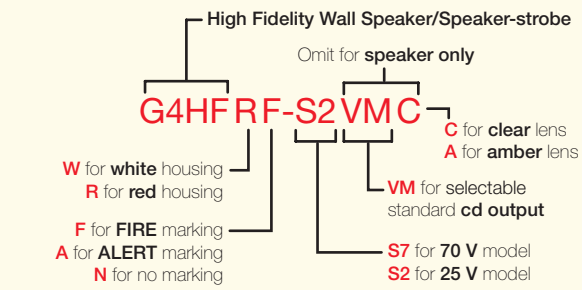
EDWARDS 520Hz HIGH FIDELITY | LOW FREQUENCY SOLUTIONS

High Fidelity

Wall Speakers, Speaker-Strobes

Genesis G4HF Series

Wall Speaker Ordering Guide



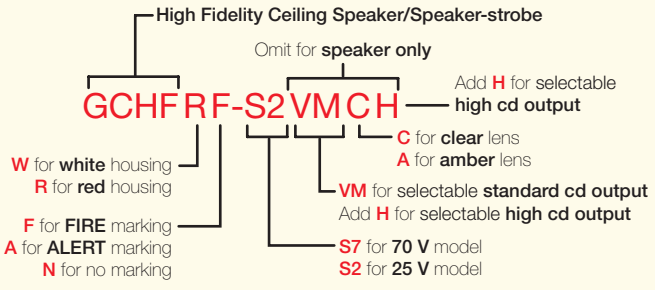
Consult Data Sheet 85001-0641 for specifications and ordering information.

High Fidelity

Ceiling Speakers, Speaker-Strobes

Genesis GCHF Series

Ceiling Speaker Ordering Guide



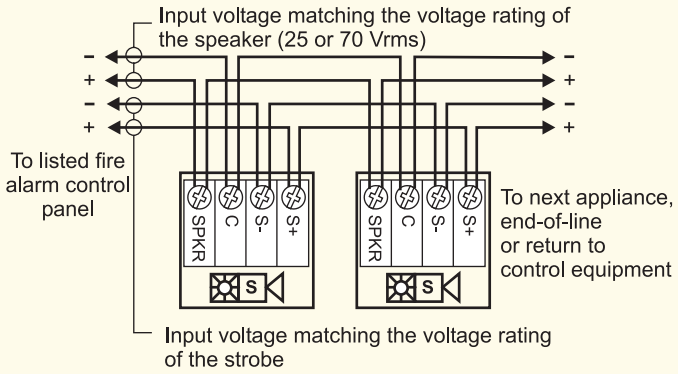
Consult Data Sheet 85001-0641 for specifications and ordering information.

Genesis Series high fidelity speakers and speaker-strobes are part of an end-to-end audio system solution for low frequency signaling. These versatile notification appliances combine high performance output with a low profile design to deliver a life safety audio solution that's as versatile as it is effective. Protruding about an inch from the mounting surface, they blend inconspicuously with any decor.

Optional amber lens tints, ALERT or FIRE markings, and red or white housing colors ensure there is a device for every application, including mass notification and emergency communications.

Speakers feature selectable wattage taps, while speaker-strobes allow for both wattage and light output levels to be configured in the field. Both settings remain clearly visible — even after final installation, which allows devices to be easily fine-tuned to achieve maximum benefit in exchange for the lowest possible system overhead.

Typical Wiring, High Fidelity Speaker-Strobe



G4HF and GCHF high fidelity speakers meet NFPA 72 standards for commercial sleeping areas where audible appliances are provided. They also produce crisp, clear voice audio output that is highly intelligible over large areas. They are ideal for hotels, dormitories, and other sleeping occupancies where supplementary audible output is necessary.

These appliances are capable of generating the distinctive factory-supplied 520 Hz signal that results in excellent waking capabilities, superb sound penetration, and an unmistakable warning of danger. To meet current codes, ensure that the wattage tap of the speaker is set sufficiently high so that the sound pressure reaches 75 dBA-fast at the pillow. Consult current codes or your Authority Having Jurisdiction for details.

EDWARDS United Technologies

Email: edwards.fire@fs.utc.com Web: www.edwardsfiresafety.com

85000-0396 09/04/15

EDWARDS 520Hz HIGH FIDELITY | LOW FREQUENCY SOLUTIONS

Low Frequency 520 Hz

Horns, Horn-strobes

Genesis G4LF Series

Horn Ordering Guide

520 Hz Low frequency horn, horn-strobe

G4LF R F-HVM

- **W** for **white** housing
- **R** for **red** housing
- **F** for **FIRE** marking
- **A** for **ALERT** marking
- **N** for no marking
- **HVM** for selectable 15, 30, 75, or 110 **cd output**
- **H** for **horn only**

Consult Data Sheet 85001-0639 for specifications and ordering information.

G4LF Series notification appliances provide the benefits of Genesis life safety signals with output suitable for applications requiring low frequency audible tones. These high-performance appliances generate a crisp 520 Hz tone in the standard 3-3 temporal pattern. An optional setting configures the appliance for continuous audible output — a critical feature for notification appliance circuits that are coded with a CDR-3 coder module. G4LF appliances also feature field-configurable high and low dB output settings.

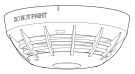
When connected to compatible EDWARDS control equipment, G4LF Series audible output remains synchronized with all Genesis audible signals on the same Notification Appliance Circuit, including standard 3.2 kHz Genesis audible signals.

Available G4LF models include audible-only appliances, as well as combination audible-visible signals. Horn-strobe devices feature field-configurable candela output. When connected to a compatible synchronization source, Genesis strobes synchronize to within 10 milliseconds indefinitely without the need for external modules or other equipment.

Low Frequency 520 Hz

Sounder Bases

for Intelligent Detectors

Sounder Base	Compatible Detectors	Application	
		Fire	Fire/CO
SB4U-LF 	 V-Series FX Series	✓	
SIGA-AB4G-LF 	 SIGA2 Series V-PCOS	✓	✓
	 SIGA Series GSA Series		

Low frequency sounder bases provide 520 Hz output suitable for applications requiring low frequency audible tones. These bases can operate as independent local alarms, or as part of a zone or system alarm with synchronized audible output.

Two models are available:

SIGA-AB4G-LF bases provide low frequency sounder capability for the SIGA2 Series and V-PCOS smoke and CO detectors, as well as SIGA and GSA Series smoke detectors. For CO applications, a Temporal Pattern Generator is required to control output based on event type, i.e.: T-3 pattern for fire events; T-4 pattern for CO events.

SB4U-LF bases provide low frequency sounder capability to V-Series and FX-Series smoke detectors.

All sounder bases match the finish of compatible devices, and the sound output slots complement the air entry openings of the detector. The end result is a compact unit with an attractive appearance.

85000-0396 09/04/15

EDWARDS United Technologies

Email: edwards.fire@fs.utc.com Web: www.edwardsfiresafety.com

Overview

Signature Series Model SIGA-HFS and SIGA-HRS Intelligent Heat Detectors gather analog information from their fixed temperature and/or rate-of-rise heat sensing elements and converts it into digital signals. The detector's on-board microprocessor measures and analyzes these signals. It compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires. Unwanted alarms are virtually eliminated.

The microprocessor in each detector provides four additional benefits - Self-diagnostics and History Log, Automatic Device Mapping, Stand-alone Operation and Fast, Stable Communication.

Standard Features

Note: *Some features described here may not be supported by all control systems. Check your control panel's Installation and Operation Guide for details.*

- 70 foot (21.3 meter) spacing
- 15° F (9° C)/min rate-of-rise/135° F (57° C) ft. and 135° F (57 ° C) fixed temperature type
- Intelligent detector c/w integral microprocessor
- Non-volatile memory
- Automatic device mapping
- Electronic addressing
- Identification of defective detectors
- Twin RED/GREEN status LEDs
- Standard, relay, fault isolator, and audible mounting bases
- Designed and manufactured to ISO 9001 standards

Intelligent Heat Detectors

SIGA-HFS & SIGA-HRS

Application Notes Available

Signature Series Overview

Self-diagnostics and History Log - Each Signature Series detector constantly runs self-checks to provide important maintenance information. The results of the self-check are automatically updated and permanently stored in the detector's non-volatile memory. This information is accessible for review any time at the control panel, PC, or by using the SIGA-PRO Signature Program/Service Tool.

In the unlikely event that an unwanted alarm does take place, the control panel's history file can be called up to help isolate the problem and prevent it from happening again.

Automatic Device Mapping - The loop controller learns where each device's serial number address is installed relative to other devices on the circuit. This mapping feature provides supervision of each device's installed location to prevent a detector from being reinstalled (after cleaning etc.) in a different location from where it was originally. The history log for the detector remains relevant and intact regardless of its new location.

The Signature Series Data Entry Program also uses the mapping feature. With interactive menus and graphic support, the wired circuits between each device can be examined. Layout or "as-built" drawing information showing wire branches (T-taps), device types and their address are stored on disk for printing hard copy. This takes the mystery out of the installation. The preparation of as-built drawings is fast and efficient.

Stand-alone Operation - A decentralized alarm decision by the detector is guaranteed. On-board intelligence permits the detector to operate in stand-alone mode. If loop controller CPU communications fail for more than four seconds, all devices on that circuit go into stand-alone mode. The circuit acts like a conventional alarm receiving circuit. Each detector on the circuit continues to collect and analyze information from its surroundings. Both the SIGA-HRS and SIGA-HFS detectors alarm if the ambient temperature increases to 135°F (57°C) or for the SIGA-HRS only, the temperature increases at a rate exceeding 15°F (9°C)/minute. If the detector is mounted to a relay base, the relay operates. Similarly, if it is mounted to an audible base, the on-board horn sounds.

Fast Stable Communication - On-board intelligence means less information needs to be sent between the detector and the loop controller. Other than regular supervisory polling response, the detector only needs to communicate with the control panel when it has something new to report. This provides very fast control panel response time and allows a lower baud rate (speed) to be used for communication on the circuit. The lower baud rate offers several advantages including:

- less sensitivity to circuit wire characteristics
- less sensitivity to noise glitches on the cable
- less emitted noise from the data wiring
- twisted or shielded wiring is not required

Electronic Addressing - The loop controller electronically addresses each detector, saving valuable time during system commissioning. Setting complicated switches or dials is not required. Each detector has its own unique serial number stored in its on-board memory. The loop controller identifies each device on the circuit and assigns a "soft" address to that device's serial number. If desired, detectors can be addressed using the SIGA-PRO Signature Program/Service Tool.

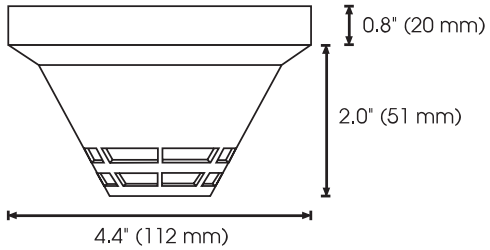
Installation Spacing - The SIGA-HFS (fixed temperature) and the SIGA-HRS (fixed temperature/rate-of-rise combination) intelligent heat detectors are rated for installation at up to 70 foot (21.3 meter) spacing. These detectors may be installed in rooms with ambient temperatures up to 100°F (38°C).

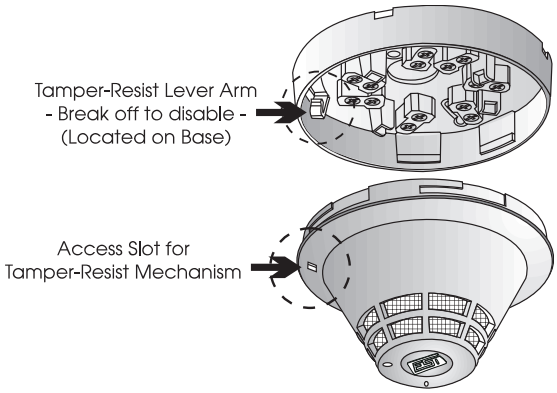
Status LEDs - Twin LEDs are visible from any direction. A flashing GREEN LED shows normal system polling from the loop controller. A flashing RED LED means the detector is in alarm state. Both LEDs on steady shows alarm state - stand-alone mode. Normal GREEN LED activity is not distracting to building occupants, but can be quickly spotted by a maintenance technician.

Quality and Reliability - GE Security detectors are manufactured in North America to strict international ISO 9001 standards. All electronics utilize surface mount technology (SMT) for smaller size and greater immunity to RF noise. A conformal coating is used for humidity and corrosion resistance. All critical contacts are gold plated.

Installation

Signature Series detectors mount to North American 1-gang boxes, 3-1/2 inch or 4 inch octagon boxes, and to 4 inch square electrical boxes 1-1/2 inches (38 mm) deep. They mount to European BESA and 1-gang boxes with 60.3 mm fixing centers.





Application

The table below shows six standard test fires used to rate the sensitivity of smoke and heat detectors. The table indicates that no single sensing element is suited for all test fires.

GE Security recommends that this detector be installed according to latest recognized edition of national and local fire alarm codes.

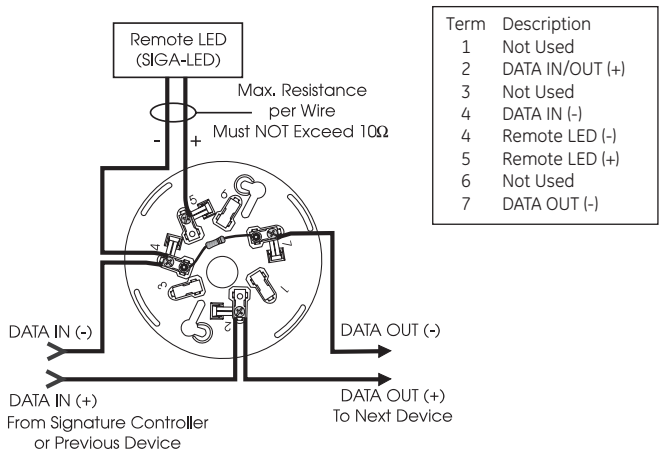
Test Fire	SIGA-IS Ion	SIGA-PS Photo	SIGA-HRS and SIGA-HFS Rate-of-Rise/ Fixed Temp.	SIGA-PHS Photo Heat 3D	SIGA-IPHS Ion/Photo/Heat 4D
Open Wood	**optimum**	unsuitable	**optimum**	very suitable	**optimum**
Wood Pyrolysis	suitable	**optimum**	unsuitable	**optimum**	**optimum**
Smouldering Cotton	very suitable	**optimum**	unsuitable	**optimum**	**optimum**
Poly Urethane Foam	very suitable	very suitable	suitable	very suitable	**optimum**
n-Heptane	**optimum**	very suitable	very suitable	**optimum**	**optimum**
Liquid Fire without Smoke	unsuitable	unsuitable	**optimum**	very suitable	very suitable

Typical Wiring

The detector mounting bases will accept #18 AWG (0.75mm^2), #16 (1.0mm^2), #14 AWG (1.5mm^2), and #12 AWG (2.5mm^2) wire sizes.

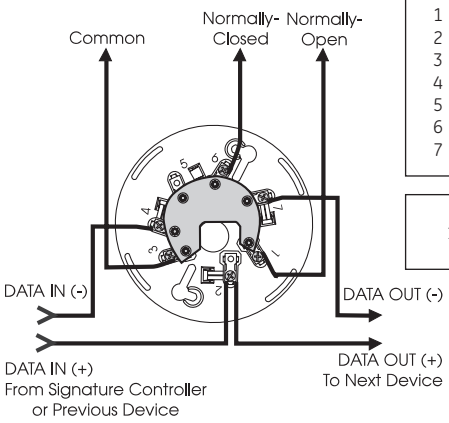
Note: Sizes #16 AWG (1.0mm^2) and #18 AWG (0.75mm^2) are preferred for ease of installation. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.

Standard Detector Base, SIGA-SB, SIGA-SB4



Term	Description
1	Not Used
2	DATA IN/OUT (+)
3	Not Used
4	DATA IN (-)
4	Remote LED (-)
5	Remote LED (+)
6	Not Used
7	DATA OUT (-)

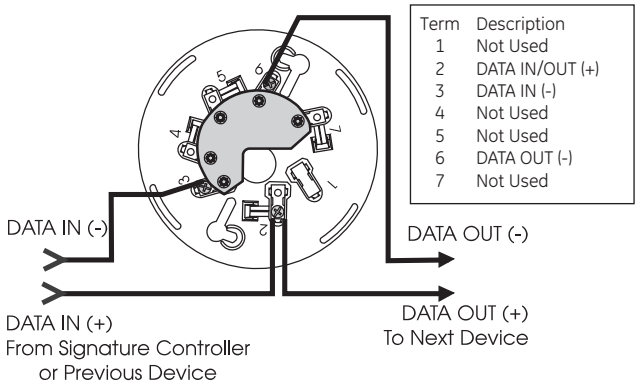
Relay Detector Base, SIGA-RB, SIGA-RB4



Term	Description
1	Normally-Open
2	DATA IN/OUT (+)
3	Common
4	DATA IN (-)
5	Not Used
6	Normally-Closed
7	DATA OUT (-)

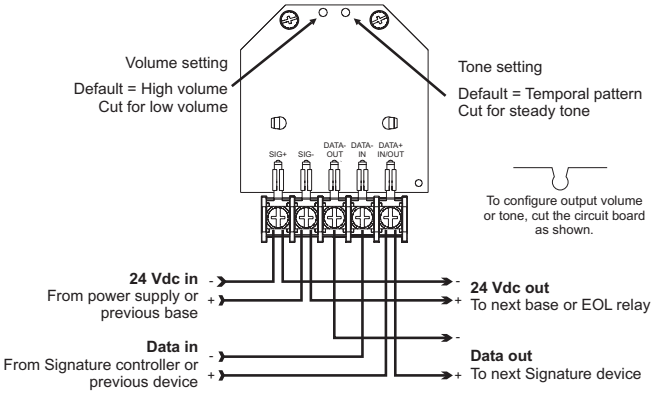
CONTACT RATING
1.0 Amp @ 30 VDC
(Pilot Duty)

Isolator Detector Base, SIGA-IB, SIGA-IB4



Term	Description
1	Not Used
2	DATA IN/OUT (+)
3	DATA IN (-)
4	Not Used
5	Not Used
6	DATA OUT (-)
7	Not Used

Audible Detector Base, SIGA-AB4G



Accessories

All detector mounting bases have wiring terminals that are accessible from the "room-side" after mounting the base to the electrical box. The bases mount to North American 1-gang boxes and to 3½ inch or 4 inch octagon boxes, 1½ inches (38 mm) deep. They also mount to European BESA and 1-gang boxes with 60.3 mm fixing centers. The SIGA-SB4, SIGA-RB4, and SIGA-IB4 mount to North American four inch square electrical boxes in addition to the above boxes. They include the SIGA-TS4 Trim Skirt which is used to cover the "mounting ears" on the base. The SIGA-AB4G mounts to a 4" sqare box only.


SIGA-AB4G
Audible Base


SIGA-SB
Standard Base


SIGA-IB
Isolator Base


SIGA-RB
Relay Base


SIGA-LED
Remote LED

Standard Base SIGA-SB, SIGA-SB4 - This is the basic mounting base for GE Security Signature Series detectors. The SIGA-LED Remote LED is supported by the Standard Base.

Relay Base SIGA-RB, SIGA-RB4 - This base includes a relay. Normally open or closed operation is selected during installation. The dry contact is rated for 1 amp (pilot duty) @ 30 Vdc. The relay's position is supervised to avoid accidentally jarring it out of position. The SIGA-RB can be operated as a control relay if programmed to do so at the control panel (EST3 V. 2 only). The relay base does not support the SIGA-LED Remote LED.

Audible Base SIGA-AB4G - This base is designed for use where localized or group alarm signaling is required. When the detector senses an alarm condition, the audible base emits a local alarm signal. The optional SIGA-CRR Polarity Reversal Relay can be used for sounding to other audible bases on the same 24 Vdc circuit.

Relay and Audible Bases operate as follows:

- at system power-up or reset, the relay is de-energized
- when a detector is installed in the base with the power on, the relay energizes for four seconds, then de-energizes
- when a detector is removed from a base with the power on, the relay is de-energized
- when the detector enters the alarm state, the relay is energized.

Isolator Base SIGA-IB, SIGA-IB4 - This base includes a built-in line fault isolator for use on Class A circuits. A detector must be installed for it to operate. The isolator base does not support the SIGA-LED Remote LED.

The isolator operates as follows:

- a short on the line causes all isolators to open within 23 msec
- at 10 msec intervals, beginning on one side of the Class A circuit nearest the loop controller, the isolators close to provide the next isolator down the line with power
- if the isolator next to the short closes, it reopens within 10 msec.

The process repeats beginning on the other side of the loop controller.

Remote LED SIGA-LED - The remote LED connects to the SIGA-SB or SIGA-SB4 Standard Base only. It features a North American size 1-gang plastic faceplate with a white finish and red alarm LED.

SIGA-TS4 Trim Skirt - Supplied with 4 inch bases, it can also be ordered separately to use with the other bases to help hide surface imperfections not covered by the smaller bases.

Warnings & Cautions

This detector will not operate without electrical power. As fires frequently cause power interruption, we suggest you discuss further safeguards with your fire protection specialist.

This detector will NOT sense fires that start in areas where heat cannot reach the detector. Heat from fires in walls, roofs, or on the opposite side of closed doors may not reach the detector to alarm it.

The heat sensor in this device only provides a source of information to supplement the information provided by photoelectric or ionization smoke detectors which may be located nearby. The heat detector by itself does NOT provide life safety protection. Under no circumstances should heat detectors be relied on as the sole means of fire protection.

Compatibility

The SIGA-HFS and SIGA-HRS detectors are compatible only with GE Security's Signature Loop Controller.

Specifications

Catalog Number	SIGA-HFS	SIGA-HRS
Heat Sensing Element	Fixed Temperature	Fixed & Temperature/ Rate-of-Rise
Alarm Point	Alarms at 135°F (57°C) Ambient	Alarms at 135°F (57°C) Ambient or Temp. increase above 15°F (9°C) per min.
UL Listed Detector Spacing	70 feet (21.3 meters) center to center spacing	
Operating and Storage Environment	Operating Temp: 32°F to 100°F (0°C to 38°C) Storage Temp: -4°F to 140°F (-20°C to 60°C) Humidity: 0 to 93% RH, Non-Condensing	
Operating Voltage	15.2 to 19.95 Vdc (19 Vdc nominal)	
Operating Current	Quiescent: 45µA @ 19 V Alarm: 45µA @ 19V Emergency Stand-alone Alarm Mode: 18mA Pulse Current: 100 µA (100 msec)	
Construction & Finish	High Impact Engineering Polymer - White	
Compatible Mounting Bases	SIGA-SB Standard Base, SIGA-RB Relay Base, SIGA-IB Isolator Base, SIGA-AB4, SIGA-AB4G Audible Bases	
LED Operation	On-board Green LED - Flashes when polled On-board Red LED - Flashes when in alarm; Both LEDs - Glow steady when in alarm (stand-alone) Compatible Remote Red LED (model SIGA-LED) Flashes when in alarm	
Compatibility	Use With: SIGNATURE Loop Controller	
Address Requirements	Uses one device address	
Agency Listings	UL, ULC, MEA, CSFM	

Ordering Information

Catalog Number	Description	Ship Wt. lbs (kg)
SIGA-HFS	Intelligent Fixed Temperature Heat Detector - UL/ULC Listed	0.5 (0.23)
SIGA-HRS	Intelligent Fixed Temperature/Rate-of-Rise Heat Detector - UL/ULC Listed	
Accessories		
SIGA-SB	Detector Mounting Base	0.2 (.09)
SIGA-SB4	4-inch Detector Mounting Base c/w SIGA-TS Trim Skirt	
SIGA-RB	Detector Mounting Base w/Relay	
SIGA-RB4	4-inch Detector Mounting Base /w Relay c/w SIGA-TS Trim Skirt	
SIGA-IB	Detector Mounting Base w/Fault Isolator	
SIGA-IB4	4-inch Detector Mounting Base w/ Fault Isolator c/w SIGA-TS Trim Skirt	
SIGA-LED	Remote Alarm LED	
SIGA-AB4G	Audible (Sounder) Base	0.3 (0.15)
SIGA-TS4	Trim Skirt (supplied with 4-inch bases)	0.1 (.04)

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F 519 376 7258

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F 852 2142 5063

Australia
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F 61 3 9259 4799

Europe
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F 32 2 721 86 13

Latin America
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F 305 593 4300

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Specifications

Catalog Number	SIGA-CC1	SIGA-MCC1	SIGA-CC2	SIGA-MCC2
Description	Single Input (Riser) Signal Module		Dual Input (Riser) Signal Module	
Type Code	50 (factory set) Two sub-types (personality codes) are available		51 (factory set) One sub-type (personality code) is available (factory set)	
Address Requirements	Uses one module address		Uses two module addresses	
Wiring Terminations	Suitable for #12 to #18 AWG (2.5 mm² to 0.75mm²)			
Mounting	North American 2½ inch (64 mm) deep two-gang boxes and 1½ inch (38 mm) deep 4 inch square boxes with 2-gang covers and SIGA-MP mounting plates	Plugs into UIO2R, UIO6R or UIO6 Motherboards	North American 2½ inch (64 mm) deep two-gang boxes and 1½ inch (38 mm) deep 4 inch square boxes with 2-gang covers and SIGA-MP mounting plates	Plugs into UIO2R, UIO6R or UIO6 Motherboards
Operating Current	Standby = 223µA Activated = 100µA			
Operating Voltage	15.2 to 19.95 Vdc (19 Vdc nominal)			
Output Rating	24 Vdc = 2 amps 25 V Audio = 50 watts 70 V Audio = 35 watts			
Construction	High Impact Engineering Polymer			
Storage & Operating Environment	Operating Temperature: 32°F to 120°F (0°C to 49°C) Storage Temperature: -4°F to 140°F (-20°C to 60°C) Humidity: 0 to 93% RH			
LED Operation	On-board Green LED - Flashes when polled On-board Red LED - Flashes when in alarm/active			
Compatibility	Use with: Signature Loop Controller			
Agency Listings	UL, ULC, CSFM, MEA			

Ordering Information

Catalog Number	Description	Ship Wt. lbs (kg)
SIGA-CC1	Single Input Signal Module (Standard Mount) - UL/ULC Listed	0.5 (0.23)
SIGA-MCC1	Single Input Signal Module (UIO Mount) - UL/ULC Listed	0.18 (0.08)
SIGA-CC2	Dual Input Signal Module (Standard Mount) - UL/ULC Listed	0.5 (0.23)
SIGA-MCC2	Dual Input Signal Module (UIO Mount) - UL/ULC Listed	0.18 (0.08)

Related Equipment		
27193-21	Surface Mount Box - Red, 2-gang	2 (1.2)
27193-26	Surface Mount Box - White, 2-gang	2 (1.2)
SIGA-UIO2R	Universal Input-Output Module Board w/Riser Inputs - Two Module Positions	0.32 (0.15)
SIGA-UIO6R	Universal Input-Output Module Board w/Riser Inputs - Six Module Positions	0.62 (0.28)
SIGA-UIO6	Universal Input-Output Module Board - Six Module Positions	0.56 (0.25)
235196P	Bi-polar Transient Protector	0.01 (0.05)

Accessories		
MFC-A	Multifunction Fire Cabinet - Red, supports Signature Module Mounting Plates	7.0 (3.1)
SIGA-MP1	Signature Module Mounting Plate, 1 footprint	1.5 (0.70)
SIGA-MP2	Signature Module Mounting Plate, 1/2 footprint	0.5 (0.23)
SIGA-MP2L	Signature Module Mounting Plate, 1/2 extended footprint	1.02 (0.46)

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Overview

Genesis ceiling speaker-strobes are small, compact, and attractive audible-visible emergency signaling devices. Protruding no more than 1.6" (41 mm) from the ceiling, Genesis speaker-strobes blend with any decor.

Signals feature textured housings in architecturally neutral white or eye-catching fire alarm red. An ingenious iconographic symbol indicates the purpose of the device. This universal symbol is code-compliant and is easily recognized by all building occupants regardless of what language they speak. Models with "FIRE" markings are also available.

Thanks to patented breakthrough technology, GE Security Genesis strobes do not require bulky specular reflectors and lenses. Instead, an exclusive cavity design conditions light to produce a highly controlled distribution pattern. Significant development efforts employing this new technology have given rise to a new benchmark in strobe performance – FullLight technology.

FullLight strobe technology produces a smooth light distribution pattern without the spikes and voids characteristic of specular reflectors. This ensures the entire coverage area receives consistent illumination from the strobe flash.

Depending on the model, Genesis speaker-strobes feature 15 to 95, or 95 to 177 candela output (see ordering information), which is selectable with a conveniently-located switch. The candela output setting remains clearly visible even after final installation, yet it is locked in place to prevent unauthorized movement after installation.

Standard Features

- **Field configurable – no need to remove the device!**
  - Select ¼, ½, 1, or 2 watt operation
  - 15/30/75/95 cd and 95/115/150/177 cd models available
  - Switch settings remain visible *even after the unit is installed*
- **Unique low-profile design**
  - 30 per cent slimmer profile than comparable signals
  - Attractive appearance
  - No visible mounting screws
  - Available with white or red housings
- **Unparalleled performance**
  - loud 90 dBA output ensures clear, crisp audio
  - Precision timing electronics meet tough synchronizing standards for strobes when used with compatible modules
  - Highly regulated in-rush current allows the maximum number of strobes on a circuit
  - 25 V_{RMS} and 70 V_{RMS} models available, all supplied with a DC blocking capacitor for audio circuit supervision
- **Easy to install**
  - Fits all standard 4" square electrical boxes with plenty of room behind the signal for extra wire – *no extension ring or trim plate needed*
  - #18 - #12 AWG terminals – ideal for long runs, existing wiring
- **Approved for public and private mode applications**
  - UL 1971-listed as signaling devices for the hearing impaired
  - UL 1638-listed as protective visual signaling appliances
  - UL 1480-listed as fire alarm speaker
  - UL/ULC listed for ceiling or wall use

Field Configurable Ceiling Speaker-strobes

Genesis Series

FM APPROVED MEA pending

Strobe Application

Genesis speaker-strobes include a DC blocking capacitor to allow electrical supervision of the audio distribution circuit. Models for 25 V_{RMS} and 70 V_{RMS} audio circuits are available. The mylar speaker with its sealed back construction is extra durable, is impervious to moisture, and provides improved audibility. ¼ W to 2 W operation is selectable with a conveniently-located switch on the front of the device. The wattage tap setting remains clearly visible even after final installation.

All Genesis speaker-strobes are fully compatible with Enhanced Integrity signals. The two product lines may be mixed on the same circuit.

Genesis speaker-strobes are UL 1971-listed for use indoors as wall or ceiling mounted public-mode notification appliances for the hearing impaired. Prevailing codes require strobes to be used where ambient noise conditions exceed 105 dBA (87dBA in Canada), where occupants use hearing protection, and in areas of public accommodation as defined in the *Americans with Disabilities Act*, which requires visible signals in the following areas:

- rest rooms, meeting rooms, and other common use areas.
- sleeping rooms intended for use by persons with hearing impairment (in accordance with Title 1 of ADA).
- work areas used by a person with a hearing impairment (per Title 1 of ADA).

Although all Genesis strobes are self-synchronizing, when installed with an optional synchronization module, strobe flashes from devices on the same circuit synchronize to within 10 milliseconds of each other *indefinitely*. This exceeds the two-hour minimum specified in the UL standards. Only one synchronization module is required per circuit.

Genesis speaker-strobes are synchronized and UL-listed for use in sleeping or non-sleeping areas. They are intended for indoor use only and are approved for wall or ceiling mount applications.

Recommended Strobes: The following guidelines are based on ANSI/NFPA 72 *National Fire Alarm Code* (2002). When applied and installed in accordance with that code, GE Security strobes meet or exceed the illumination produced by the ADA-specified 75 candela (cd) strobe at 50 feet. (ADA suggests using 75 cd strobes throughout an area, with spacing that never exceeds 50 ft. from the strobe to any point in the protected space.)

WARNING: These devices will not operate without electrical power. As fires frequently cause power interruptions, we suggest you discuss further safeguards with your local fire protection specialist. Research indicates that the intensity of strobe needed to awaken 90% of sleeping persons is approximately 100 cd. GE Security recommends that strobes in sleeping rooms be set to 110 cd minimum.

Non-Sleeping Areas and Corridors: GE Security strobes rated at less than 110 cd per UL 1971 are intended for use in non-sleeping areas only. Install with the bottom of the device at least 80 inches (2.0 m) and no more than 96 inches (2.4 m) above the finished floor. No point in any space (including corridors) required to have strobes should be more than 50 feet (15.2 m) from the signal (in the horizontal plane).

Room Type	Maximum Area (square room size)	Maximum Ceiling Height	Recommended Ceiling mount Genesis Strobe
Non-sleeping Rooms (ceiling mounted)	20 x 20 ft. (6.1 x 6.1 m)	10 feet (3.05 m)	15 cd
	30 x 30 ft. (9.1 x 9.1 m)		30 cd
	40 x 40 ft. (12.2 x 12.2 m)		75 cd
	50 x 50 ft. (15.2 x 15.2 m)		95 cd
	20 x 20 ft. (6.1 x 6.1 m)	20 feet (6.10 m)	30 cd
	30 x 30 ft. (9.1 x 9.1 m)		75 cd
	40 x 40 ft. (12.2 x 12.2 m)		95 cd
	50 x 50 ft. (15.2 x 15.2 m)		115 cd
	20 x 20 ft. (6.1 x 6.1 m)	30 feet (9.14 m)	75 cd
	30 x 30 ft. (9.1 x 9.1 m)		75 cd
	40 x 40 ft. (12.2 x 12.2 m)		115 cd
	50 x 50 ft. (15.2 x 15.2 m)		150 cd

Note: Recommendations in the table above assume the strobe is placed in the center of the room. If not, the maximum room size is determined by doubling the distance from the strobe to the farthest wall.

Sleeping areas: In sleeping areas, ceiling mounted strobes (and wall mounted strobes installed less than 24 inches from the ceiling) must be rated at a minimum of 177 cd. Wall mounted strobes installed more than 24 inches (610 mm) from the ceiling must be rated at a minimum of 110 cd. In all cases, the distance from the strobe to the pillow must not exceed 16' (4.8 m).

For detailed spacing requirements, consult *The Handbook of Visible Notification Appliances for Fire Alarm Applications* published by GE Security Press, or contact your local GE Security representative.

Speaker Application

The suggested sound pressure level for each signaling zone used with alert or alarm signals is a minimum of 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds, whichever is greater. This is measured 5 feet (1.5 m) above the floor. The average ambient sound level is the A-weighted sound pressure measured over a 24-hour period.

Doubling the distance from the signal to the ear will theoretically cause a 6 dB reduction in the received sound pressure level. The actual effect depends on the acoustic properties of materials in the space. Doubling the power output of a device (e.g.: a speaker from 1 W to 2 W) will increase the sound pressure level by 3 dBA. A 3 dBA difference represents a barely noticeable change in volume.

Combination audible/visual signals must be installed in accordance with guidelines established for strobes.

Application Notes - Canada

(Based in part on 1995 Canada National Building Code)

The fire alarm signal sound pressure level shall not exceed 110 dBA in any normally occupied area. The sound pressure level from an audible signal in a floor area used for occupancies other than residential occupancies shall not be less than 10 dBA above ambient levels, and never less than 65 dBA. In sleeping rooms the sound pressure level from an audible signal shall not be less than 75 dBA when any intervening doors between the device and the sleeping room are closed.

The fire alarm audible signal shall be supplemented by fire alarm strobes in any floor area where the ambient noise level exceeds 87 dBA, or where the occupants of the floor area use ear protective devices, are located within an audiometric booth, or are located within sound insulating enclosures. This also applies to assembly occupancies in which music and other sounds associated with performances could exceed 100 dBA. Strobes shall be installed in a building so that the flash from one device is visible throughout the floor area or portion thereof in which they are installed.

Current Draw

UL Nameplate Rating

	15 cd	30 cd	75 cd	95 cd
	RMS	RMS	RMS	RMS
16 Vdc	109	151	281	318
16 Vfwr	131	194	379	437

UL Nameplate Rating (high cd output models)

95 cd	115 cd	150 cd	177 cd
RMS	RMS	RMS	RMS
330	392	502	565
432	518	643	693

Typical Current

	15 cd		30 cd		75 cd		95 cd	
	RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean
16 Vdc	94	87	140	135	273	268	325	323
20 Vdc	74	68	108	105	205	203	244	242
24 Vdc	63	59	90	88	168	166	194	192
33 Vdc	48	46	70	68	124	123	139	138
16 Vfwr	126	67	187	108	368	231	403	260
20 Vfwr	108	54	156	84	281	168	333	199
24 Vfwr	97	47	139	71	240	135	270	156
33 Vfwr	89	39	119	56	197	100	214	111

Typical Current (high cd output models)

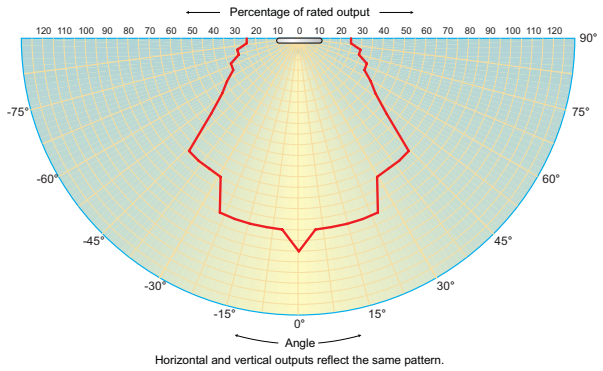
95 cd		115 cd		150 cd		177 cd	
RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean
333	330	392	390	499	496	551	545
259	257	303	301	378	375	429	426
212	210	245	243	306	304	342	340
155	153	180	174	211	209	236	234
484	283	570	339	673	411	724	446
380	212	438	248	537	312	604	352
318	172	361	198	434	243	484	273
245	123	269	137	308	160	338	176

Notes and Comments

1. Current values are shown in mA.
2. UL nameplate rating is higher than typical current due to measurement methods and instruments used.
3. GE Security recommends using the typical current for system design including NAC and Power Supply loading and voltage drop calculations.
4. Use the Vdc RMS current ratings for filtered power supply and battery AH calculations. Use the Vfwr RMS current ratings for unfiltered power supply calculations.
5. Fuses, circuit breakers and other overcurrent protection devices are typically rated for current in RMS values. Most of these devices operate based upon the heating affect of the current flowing through the device. The RMS current (not the mean current) determines the heating affect and therefore, the trip and hold threshold for those devices.
6. Our industry has used 'mean' currents over the years. However, UL will direct the industry to use the 2004 RMS values in the future.

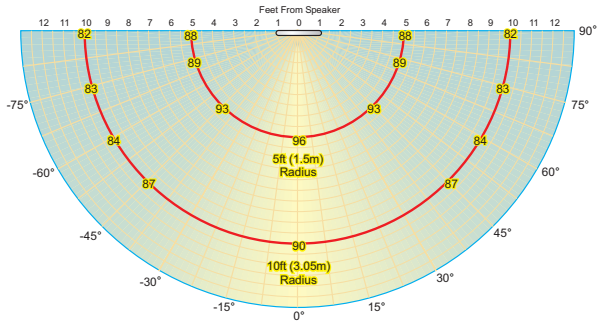
Light output - (effective cd)

Percent of UL rating versus angle



Horizontal and vertical outputs reflect the same pattern.

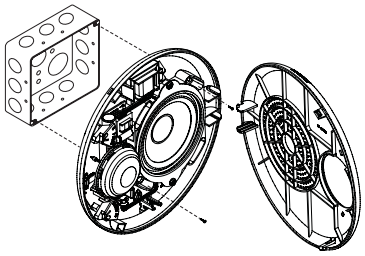
Typical Sound Output (dBA)



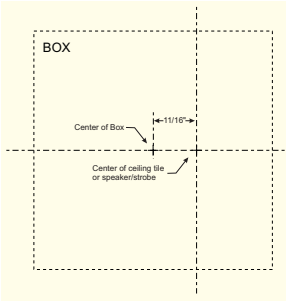
Measured at 2 watts setting in anechoic chamber

Installation and Mounting

All models are intended for indoor ceiling or wall applications only. Speaker-strobes are mounted to a flush North-American 4" square electrical box, $2^{1}/_{8}$" (54 mm) deep.

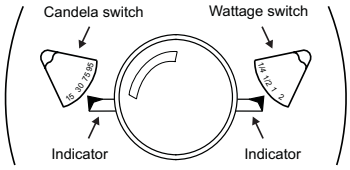


Genesis ceiling speaker-strobes simply unlatch and hinge down to open. This gains access to mounting screws and the selectable candela wattage tap switches. The shallow depth of Genesis devices leaves ample room behind the signal for extra wiring. Once installed with the cover in place, no mounting screws are visible.



Caution:
When installed, these devices are not centered on the electrical box. Make sure boxes are mounted to compensate for this difference. Use the mounting template provided with installation sheet 3100614.

Field Configuration



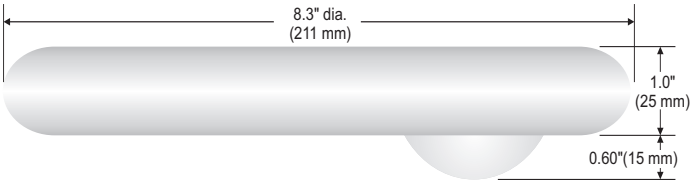
Genesis ceiling speaker-strobes may be set for ¼, ½, 1, or 2 watt operation. Depending on the model, Genesis ceiling speaker-strobes may also be set for 15/30/75/95 or 96/115/150/177 candela output (see ordering information). Output settings are changed by simply opening the device and sliding the switches to the desired settings. The speaker-strobe does not have to be removed to change the output settings. The settings remain visible through small windows on the front of the device after the cover is closed.

Sound Level Output

Wattage	25V	25V	70V	70V
	UL Rated*	Typical	UL Rated*	Typical
¼ W	80 dBA	80.7 dBA	80 dBA	81.1 dBA
½ W	84 dBA	83.7 dBA	84 dBA	83.5 dBA
1 W	87 dBA	87 .1 dBA	87 dBA	87.2 dBA
2 W	90 dBA	90.1 dBA	91 dBA	90.2 dBA

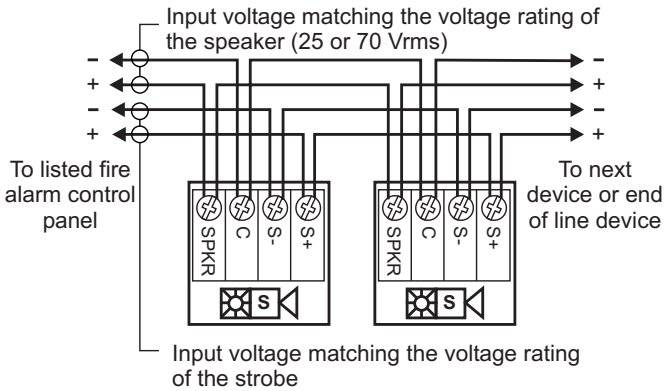
***Sound level output notes:** dBA = Decibels, A-weighted. **UL1480:** Sound level output at 10 ft (3.05 m) measured in a reverberant room using 400 to 4,000 Hz band limited pink noise. **ULC-S541:** Meets or exceeds 85 dBA in an anechoic chamber at 10 ft (3.05 m). **Directional characteristics:** Within 6 dB of on-axis sound level when measured 90° off-axis (horizontal).

Dimensions



Wiring

Field wiring terminals accommodate #18 to #12 AWG (0.75 mm² to 2.5 mm²) wiring.



Specifications

Housing	Textured UV stabilized, color impregnated engineered plastic. Exceeds 94V-0 UL flammability rating. Red and white models available.
Mounting	Flush mount to North American 4-inch square electrical box, 2-1/8 (54 mm) inches deep, or 960A-4RF round flush box. No extension ring required. Suitable for indoor wall or ceiling applications.
Wire connections	Screw terminals: polarized inputs for speaker, #18 to #12 AWG (0.75 mm² to 2.5 mm²) wire size
Operating environment	Indoor: 32-120° F (0-49° C) ambient temperature; 0-93% relative humidity.
Agency listings/approvals	Meets ULC-S541, year 2004 UL requirements for standards UL1638 and UL1971, CSFM, and complies with UL1480 Fifth Edition. All speaker-strobes comply with ADA Code of Federal Regulation Chapter 28 Part 36 Final Rule. FM and MEA pending.
Speaker	
Input/Operating Volts	25 Vrms (Model GC-S2VM) or 70 Vrms (Model GC-S7VM).
Speaker Cone	Speaker frequency response: 250 - 13,000 Hz. Optimized for voice intelligibility. 4-inch (102mm) mylar cone, sealed back construction, rated for 8 watts, 8 ohm voice coil.
Strobe	
Strobe output rating	UL 1971, UL 1638, ULC S526: selectable 15/30/75/95 cd (VM models) and 95/115/150/177 cd (VMH models)
Strobe operating voltage	GC-S2VM/-S7VM series speaker-strobes: non-coded, filtered 16-33 Vdc or unfiltered 16-33 Vdc FWR
Strobe flash rate	GC-S2VM/-S7VM series speaker-strobes: one flash per second synchronized with optional G1M Genesis Signal Master indefinitely within 10 milliseconds (or self-synchronized within 200 milliseconds over thirty minutes on a common circuit without G1M Genesis Signal Master) Temporal setting (private mode only): synchronized to temporal output of Genesis audible signals on same circuit
Synchronization	Meets or exceeds UL 1971 requirements. Maximum allowed resistance between any two devices is 20 Ohms. Refer to specifications for the synchronization control module, this strobe, and the control panel to determine allowed wire resistance.
Compatible synchronization modules	G1M-RM, SIGA-CC1S, SIGA-MCC1S
Lens	Optical grade polycarbonate (clear)

Ordering Information

All speaker-strobes include field-selectable ¼, ½, 1, or 2 watt taps

Catalog Number	Housing Color	Marking	Description	Ship Wt. lbs (kg)
GC- S2VM	White	None	25 Volt Speaker-strobe with selectable 15, 30, 75, or 95 cd output	2.25 (1.0)
GCF- S2VM	White	"Fire"		
GCFR- S2VM	Red	"Fire"		
GC- S2VMH	White	None	25 Volt Speaker-strobe with selectable 95, 115, 150, or 177 cd output	2.25 (1.0)
GCF- S2VMH	White	"Fire"		
GC- S7VM	White	None	70 Volt Speaker-strobe with selectable 15, 30, 75, or 95 cd output	2.25 (1.0)
GCF- S7VM	White	"Fire"		
GCFR- S7VM	Red	"Fire"		
GC- S7VMH	White	None	70 Volt Speaker-strobe with selectable 95, 115, 150, or 177 cd output	2.25 (1.0)
GCF- S7VMH	White	"Fire"		

Accessories		
G1M-RM	Genesis Signal Master Module (1-gang)	0.2 (0.1)
SIGA-CC1S	Intelligent Synchronization Output Module (2-gang)	0.5 (0.23)
SIGA-MCC1S	Intelligent Synchronization Output Module (Plug-in UIO)	0.18 (0.08)

White Field configurable Speaker-Strobes may be ordered with or without 'FIRE' marking. Red Speaker-Strobes come with "FIRE" marking.

GE Security recommends that these fire alarm speaker-strobes always be installed in accordance with the latest recognized edition of national and local fire alarm codes.

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T 888-378-2329
F 866-503-3996

Canada
T 519 376 2430
F 519 376 7258

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F 852 2142 5063

Australia
T 61 3 9259 4700
F 61 3 9259 4799

Europe
T 32 2 725 11 20
F 32 2 721 86 13

Latin America
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F 305 593 4300

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imagination at work

Overview

The Genesis line of signals are among the smallest, most compact audible-visible emergency signaling devices in the world. About the size of a deck of playing cards, these devices are designed to blend with any decor.

Thanks to patented breakthrough technology, GE Security Genesis strobes do not require bulky specular reflectors and lenses. Instead, an exclusive cavity design conditions light to produce a highly controlled distribution pattern. Significant development efforts employing this new technology have given rise to a new benchmark in strobe performance – FullLight technology.

FullLight strobe technology produces a smooth light distribution pattern without the spikes and voids characteristic of specular reflectors. This ensures the entire coverage area receives consistent illumination from the strobe flash. As a result, Genesis strobes with FullLight technology go well beyond the minimum UL-required "T" pattern, significantly exceeding UL-1971 and ULC-S526 light distribution requirements.

Genesis strobes and horn-strobes offer 15 to 110 candela output, which is selectable with a conveniently-located switch on the side of the device. Models are also available that offer fixed 15/75 cd output. The candela output setting remains clearly visible even after final installation, yet it stays locked in place to prevent unauthorized tampering.

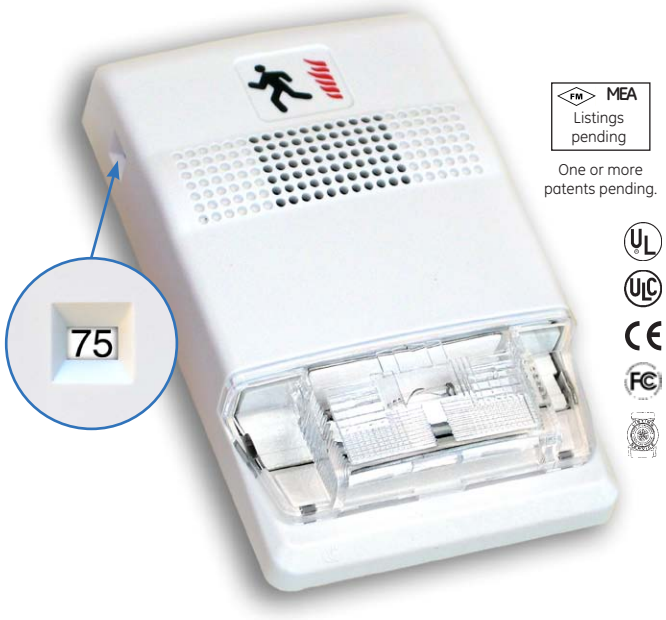
Genesis signals feature textured housings in architecturally neutral white or traditional fire red. An ingenious iconographic symbol indicates the purpose of the device. This universal symbol is code-compliant and is easily recognized by all building occupants regardless of what language they speak. Models with "FIRE" markings are also available.

Standard Features

- **Unique low-profile design**
  - The most compact UL-1971/ULC-S526 listed strobe available
  - Ultra-slim – protrudes less than one inch
  - Attractive appearance
  - No visible mounting screws
- **Four field-configurable options in one device**
  - Select 15, 30, 75, or 110 cd strobe output
  - Select high (default) or low dB horn output
  - Select temporal (default) or steady horn output
  - Select public mode flash rate (default) or private mode temporal flash
- **Fixed 15/75 cd model available**
- **Easy to install**
  - Fits standard 1-gang electrical boxes – no trim plate needed
  - Optional trim plate accommodates oversized openings
  - Pre-assembled with captive hardware
  - #12 AWG terminals – ideal for long runs or existing wiring
- **Unparalleled performance**
  - Industry's most even light distribution
  - Meets tough synchronizing standards for strobes
  - Single microprocessor controls both horn and strobe
  - Low current draw minimizes system overhead
  - Independent horn control over a single pair of wires
  - Highly regulated in-rush current
  - Multiple frequency tone improves sound penetration
  - Industry's first temporal strobe output

Field Configurable Horns and Strobes

Genesis Series



FM MEA Listings pending

One or more patents pending.

Application

Genesis strobes are UL 1971-listed for use indoors as wall-mounted public-mode notification appliances for the hearing impaired. Prevailing codes require strobes to be used where ambient noise conditions exceed 105 dBA (87dBA in Canada), where occupants use hearing protection, and in areas of public accommodation as defined in the *Americans with Disabilities Act (see application notes – USA)*.

Combination horn-strobe signals must be installed in accordance with guidelines established for strobe devices.

Strobes

Although all Genesis strobes are self-synchronizing, when installed with an optional synchronization module, strobe flashes from devices on the same circuit synchronize to within 10 milliseconds of each other *indefinitely*. This exceeds the two-hour minimum specified in the UL standards. Only one synchronization module is required per circuit.

The following guidelines are based on ANSI/NFPA 72 *National Fire Alarm Code* (1999). When applied and installed in accordance with that code, GE Security strobes meet or exceed the illumination produced by the ADA-specified 75 candela (cd) strobe at 50 feet.*

Non-Sleeping Rooms and Corridors: GE Security strobes rated at less than 110 cd per UL 1971 are intended for use in non-sleeping areas only. Install with the bottom of the device at least 80 inches (2.0 m) and no more than 96 inches (2.4 m) above the finished floor. No point in any space (including corridors) required to have strobes should be more than 50 feet (15.2 m) from the signal (in the horizontal plane).

Non-Sleeping Rooms	Use One Wall Mounted Model:
Up to 20' x 20' (6.1 x 6.1m)	One 15 cd strobe
Up to 30' x 30' (9.1 x 9.1m)	One 30 cd or two 15 cd strobes
Up to 40' x 40' (12.2 m x 12.2 m)	One 75 cd or two 30 cd strobes
Up to 50' x 50' (15.2 x 15.2m)	One 110 cd or two 75 cd strobes

Corridors	Wall Mounted - Model:
Any Length x Max. 20' (6.1m) Wide	15 cd strobes spaced at 100' (30.5 m) max. Strobes must be placed within 15' (4.5m) of each end of the corridor.

** ADA suggests using 75 cd strobes throughout an area, with spacing that never exceeds 50 ft from the strobe to any point in the protected space.*

Sleeping rooms: GE Security 110 cd strobes are intended for use in sleeping rooms and should be installed along with a smoke detector. It must be wall mounted at least 80" (2.03 m) above floor level, but no closer than 24" (610 mm) to the ceiling. The distance from the strobe to the pillow must not exceed 16' (4.8 m).

Sleeping Rooms	Use One Wall Mounted Model:
Any Size	110 cd within 16 feet of pillow

For 177 cd ceiling horn-strobes, please refer to data sheet 85001-0559.

Horns

Genesis horn output reaches as high as 99 dB and features a unique multiple frequency tone that results in excellent sound penetration and an unmistakable warning of danger. Horns may be configured for either coded or non-coded signal circuits. They can also be set for low dB output with a jumper cut that reduces horn output by about 5 dB. Horn-only models may be ceiling-mounted or wall-mounted.

The suggested sound pressure level for each signaling zone used with alert or alarm signals is at least 15 dB above the average ambient sound level, or 5 dB above the maximum sound level having a duration of at least 60 seconds, whichever is greater, measured 5 feet (1.5 m) above the floor. The average ambient sound level is, A-weighted sound pressure measured over a 24-hour period.

Doubling the distance from the signal to the ear will theoretically result in a 6 dB reduction of the received sound pressure level. The actual effect depends on the acoustic properties of materials in the space. A 3 dBA difference represents a barely noticeable change in volume.

Application Notes - USA

Audible signals in the public mode should never have a sound level less than 75 dBA at 10' (3 m) per NFPA 72. Signals cannot exceed 120 dBA per ADA and NFPA 72 at the minimum hearing distance to audible appliance.

Strobe and combination horn/strobe devices should be installed with the bottom of the device at least 80 inches (2.0 m) and no more than 96 inches (2.4 m) above the finished floor. Horns should be installed with their tops not less than 6 inches (152 mm) below the ceiling and not less than 90 inches (2.3 m) above the finished floor.

Strobes must be used to supplement audible signals wherever the average ambient sound level exceeds 105 dBA. Combination audible/visual signals must be installed in accordance with NFPA guidelines established for strobes.

ADA requires visible signals in the following areas:

- rest rooms, meeting rooms, and other common use areas.
- sleeping rooms intended for use by persons with hearing impairment (in accordance with Title 1 of ADA).
- work areas used by a person with a hearing impairment (per Title 1 of ADA).

Application Notes - Canada

(Based in part on 1995 Canada National Building Code)

The fire alarm signal sound pressure level shall not exceed 110 dBA in any normally occupied area. The sound pressure level from an audible signal in a floor area used for occupancies other than residential occupancies shall not be less than 10 dBA above ambient levels, and never less than 65 dBA. In sleeping rooms the sound pressure level from an audible signal shall not be less than 75 dBA when any intervening doors between the device and the sleeping room are closed. Audible signal devices shall be installed not less than 1.8 m to the center of the device above the floor (per CAN/ULC S524).

The fire alarm audible signal shall be supplemented by fire alarm strobes in any floor area where the ambient noise level exceeds 87 dBA, or where the occupants of the floor area use ear protective devices, are located within an audiometric booth, or are located within sound insulating enclosures. This also applies to assembly occupancies in which music and other sounds associated with performances could exceed 100 dBA

Strobes shall be installed in a building so that the flash from one device is visible throughout the floor area or portion thereof in which they are installed. For maximum safety, GE Security recommends that strobes be installed as per the guidelines shown here under Strobe Spacing.

Installation

Genesis horns and strobes mount to any standard one-gang surface or flush electrical box. Matching optional trim plates are used to cover oversized openings and can accommodate one-gang, two-gang, four-inch square, or octagonal boxes, and European 100 mm square.

Genesis Horn/Strobe with optional trim plate

All Genesis signals come pre-assembled with captive mounting screws for easy installation. Two tabs at the top of the signal unlock the cover to reveal the mounting hardware. The shallow depth of Genesis devices leaves ample room behind the signal for extra wiring. Once installed with the cover in place, no mounting screws are visible.

Field Configuration

Temporal horn and horn-strobe models are factory set to sound in a **three-pulse temporal pattern**. Units may be configured for use with coded systems by cutting a jumper on the circuit board. This results in a **steady output** that can be turned on and off (coded) as the system applies and removes power to the signal circuit. A Genesis Signal Master is required when horn-strobe models are configured for coded systems. Non-temporal, horn-only models sound a steady tone.

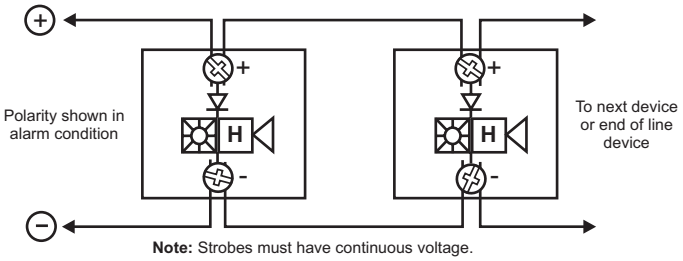
Genesis strobes and horn-strobes are shipped from the factory ready for use as **UL 1971 compliant** signals for public mode operation. These signals may be configured for **temporal flash** by cutting a jumper on the circuit board. This battery-saving feature is intended for private mode signaling only.

Genesis strobes and horn-strobes may be set for **15, 30, 75, or 110 candela output**. The output setting is changed by simply opening the device and sliding the switch to the desired setting. The device does not have to be removed to change the output setting. The setting remains visible through a small window on the side of the device after the cover is closed.

Horns and horn-strobes are factory set for **high dB output**. **Low dB output** may be selected by cutting a jumper on the circuit board. This reduces the output by about 5 dB.

Wiring

Field wiring terminals accommodate #18 to #12 AWG (0.75 mm² to 2.5 mm²) wiring. Horns, strobes, and combination horn-strobes are interconnected with a single pair of wires as shown below.



Note: Strobes must have continuous voltage.

WARNING: These devices will not operate without electrical power. As fires frequently cause power interruptions, we suggest you discuss further safeguards with your local fire protection specialist.

These visual signal appliances' flash intensity may not be adequate to alert or waken occupants in the protected area. Research indicates that the intensity of strobe needed to awaken 90% of sleeping persons is approximately 100 cd. GE Security recommends that strobes in sleeping rooms be 110 cd minimum.

Current Draw

Strobes, Horn-Strobes

Multi-cd Wall Strobes (G1-VM)

UL Rating	15 cd*	30 cd*	15/75 cd**	75 cd*	110 cd*
	RMS	RMS	RMS	RMS	RMS
16 Vdc	103	141	152	255	311
16 Vfwr	125	179	224	346	392

*G1-VM multi-cd; **G1F-V1575 fixed 15/75 cd

Typical Current	15 cd		30 cd		15/75		75 cd		110 cd	
	RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean
16 Vdc	85	79	127	124	150	140	245	243	285	283
20 Vdc	71	66	98	96	123	114	188	186	240	238
24 Vdc	59	55	82	80	104	97	152	150	191	190
33 Vdc	46	44	64	63	84	77	112	111	137	136
16 Vfwr	119	64	169	97	223	126	332	203	376	240
20 Vfwr	103	51	143	76	189	100	253	150	331	198
24 Vfwr	94	44	129	65	169	85	218	121	262	152
33 Vfwr	87	37	112	52	148	68	179	89	205	106

Wall Temporal Horn-strobes – High dB Setting

UL Rating	15 cd*	30 cd*	15/75 cd**	75 cd*	110 cd*
	RMS	RMS	RMS	RMS	RMS
16 Vdc	129	167	172	281	337
16 Vfwr	176	230	269	397	443

*G1-HDVM multi-cd
**G1F-HDV1575 fixed 15/75 cd

Typical Current	15 cd		30 cd		15/75		75 cd		110 cd	
	RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean
16 Vdc	102	89	135	129	160	152	246	242	309	305
20 Vdc	88	77	109	104	137	129	193	190	248	243
24 Vdc	81	71	94	90	122	114	161	158	203	200
33 Vdc	74	64	72	74	106	98	124	121	154	151
16 Vfwr	144	77	182	106	247	143	352	212	393	249
20 Vfwr	141	68	162	87	220	120	274	158	362	210
24 Vfwr	136	65	152	76	203	106	235	133	282	165
33 Vfwr	125	54	144	65	196	94	201	101	232	123

Wall Temporal Horn-strobes – Low dB Setting

UL Rating	15 cd*	30 cd*	15/75 cd**	75 cd*	110 cd*
	RMS	RMS	RMS	RMS	RMS
16 Vdc	122	160	146	274	330
16 Vfwr	162	216	231	383	429

*G1-HDVM multi-cd
**G1F-HDV1575 fixed 15/75 cd

Typical Current	15 cd		30 cd		15/75		75 cd		110 cd	
	RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean	RMS	Mean
16 Vdc	96	84	130	124	158	149	243	240	302	297
20 Vdc	79	70	104	99	133	124	189	186	241	237
24 Vdc	68	61	88	84	119	110	156	154	197	193
33 Vdc	56	52	71	68	100	93	118	116	146	143
16 Vfwr	128	69	180	104	241	139	344	204	389	244
20 Vfwr	118	60	157	84	213	115	266	156	343	200
24 Vfwr	113	54	144	74	195	101	230	128	279	161
33 Vfwr	112	48	137	64	182	87	197	99	226	117

Horns

Wall or Ceiling Mounted Temporal Horns (G1-HD)

UL Rating	High dB (RMS)	Low dB (RMS)
16 Vdc	26	19
24 Vdc	36	27
33 Vdc	41	33
16 Vfwr	51	37
24 Vfwr	69	52
33 Vfwr	76	70

Typical Current	High dB		Low dB	
	RMS	Mean	RMS	Mean
16 Vdc	22	17	17	14
20 Vdc	24	19	19	16
24 Vdc	27	21	22	18
33 Vdc	32	25	26	22
16 Vfwr	34	15	30	14
20 Vfwr	40	19	34	16
24 Vfwr	45	21	38	18
33 Vfwr	52	24	47	22

Wall or Ceiling Mounted Horns (G1-P)

UL Designation	Voltage Range	Max. Current, RMS
Regulated 24 Vdc	16 - 33 Vdc	13 mA
24 fwr	16 - 33 Vfwr	11 mA

Typical Current	RMS	Mean
24 Vdc	10	10
24 Vdc	11	11
31 Vdc	12	12
20 Vfwr	9	8
24 Vfwr	10	9

Notes and Comments

1. Current values are shown in mA.
2. UL Nameplate Rating can vary from Typical Current due to measurement methods and instruments used.
3. GE Security recommends using the Typical Current for system design including NAC and Power Supply loading and voltage drop calculations.
4. Use the Vdc RMS current ratings for filtered power supply and battery AH calculations. Use the Vfwr RMS current ratings for unfiltered power supply calculations.
5. Fuses, circuit breakers and other overcurrent protection devices are typically rated for current in RMS values. Most of these devices operate based upon the heating affect of the current flowing through the device. The RMS current (not the mean current) determines the heating affect and therefore, the trip and hold threshold for those devices.
6. Our industry has used 'mean' currents over the years. However, UL will direct the industry to use the 2004 RMS values in the future.

dBA output

Temporal Horns, Horn-strobes (G1-HD, G1-HDVM series)

High dB Setting	UL464		Average	Peak
	Temporal	Steady	Temporal/ Steady	Temporal/ Steady
16 Vdc	81.4	85.5	91.4	94.2
24 Vdc	84.4	88.6	94.5	97.6
33 Vdc	86.3	90.4	96.9	99.5

Low dB Setting	UL464		Average	Peak
	Temporal	Steady	Temporal/ Steady	Temporal/ Steady
16 Vdc	76.0	80.1	86.3	89.2
24 Vdc	79.4	83.5	89.8	92.5
33 Vdc	82.1	86.5	92.5	95.3

Steady Tone Horns (G1-P series)

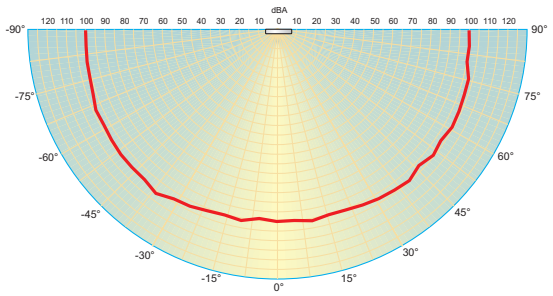
	UL464	Average	Peak
16 Vdc	77 dBA, min	85 dBA	91 dBA
16 Vfwr	77 dBA, min	85 dBA	91 dBA

Notes

1. All values shown are dBA measured at 10 feet (3.01m).
2. UL464 values measured in reverberation room.
3. Average and Peak values are measured in anechoic chamber.

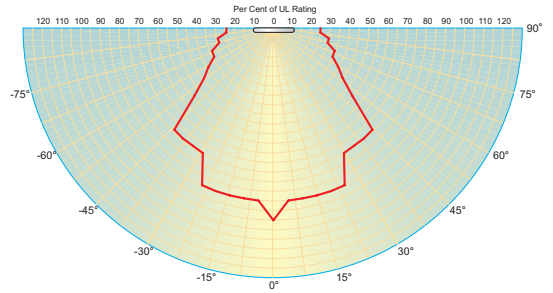
Average Sound Output (dBA)

(High dB setting, anechoic, 24V, measured at 10ft)



Light output - (effective cd)

Percent of UL rating versus angle



Specifications

Housing	Red or white textured UV stabilized, color impregnated engineered plastic. Exceeds 94V-0 UL flammability rating.
Lens	Optical grade polycarbonate (clear)
Mounting (indoor only)	Strobes and horn-strobes are for wall-mount installation only. Horn-only models may be ceiling- or wall-mounted. Flush mount: 2½ inch (64 mm) deep one-gang box Surface mount: Model 27193 surface mount box, wiremold box, or equivalent surface-mount box With optional trim plate: One-gang, two-gang, four-inch square, octagonal, or European single-gang box
Wire connections	Screw terminals: single input for both horn and strobe. #18 to #12 AWG (0.75 mm² to 2.5 mm²) wire size
Operating environment	Indoor only: 32-120°F (0-49°C) ambient temperature. 93% relative humidity
Agency listings/approvals	UL 1971, UL 1638, UL 464, ULC S525, ULC S526, CSFM, CE, FCC, (MEA, FM pending). (All models comply with ADA Code of Federal Regulation Chapter 28 Part 36 Final Rule.)
Dimensions (HxWxD)	Signal: 4-1/2" x 2-3/4" x 13/16" (113 mm x 68 mm x 21 mm) Trimplate: 5" (127 mm); Height – 5-7/8" (149 mm); Depth – ½" (13 mm)
Operating voltage	G1-HD series temporal-tone horns: non-coded, filtered 16-33 Vdc or unfiltered 16-33 Vdc FWR (or coded when horn set to steady tone) G1-HDVM series temporal-tone horn-strobes: non-coded, filtered 16-33 Vdc or unfiltered 16-33 Vdc FWR (or coded (audible NAC only) when used with optional G1M Genesis Signal Master) G1-VM series strobes: non-coded, filtered 16 - 33 Vdc or unfiltered 16-33 Vdc FWR G1-P series steady-tone horns: coded or non-coded, filtered 20-31 Vdc or unfiltered 20-27 Vfwr
Strobe output rating	UL 1971, UL 1638, ULC S526: selectable 15 cd, 30 cd, 75 cd, or 110 cd output UL 1971: 15 cd (fixed 15/75 cd models) UL 1638, ULCS526: 75 cd (fixed 15/75 cd models)
Strobe flash rate	G1-VM strobes and G1-HDVM series temporal-tone horn-strobes: one flash per second synchronized with optional G1M Genesis Signal Master indefinitely within 10 milliseconds (or self-synchronized within 200 milliseconds over thirty minutes on a common circuit without G1M Genesis Signal Master) Temporal setting (private mode only): synchronized to temporal output of horns on same circuit
Compatible synchronization modules*	G1M, G1M-RM, SIGA-CC1S, SIGA-MCC1S
Horn pulse rate	G1-HD temporal-tone horns and G1-HDVM series temporal-tone horn-strobes: temporal rate synchronized with optional G1M Genesis Signal Master indefinitely within 10 milliseconds (or self-synchronized within 200 milliseconds over thirty minutes on a common circuit without G1M Genesis Signal Master) G1-P steady-tone horns: continuous, steady tone only
Temporal audible pattern	½ sec ON, ½ sec OFF, ½ sec ON, ½ sec OFF, ½ sec ON, 1½ sec OFF, then repeat cycle

* Not compatible with G1-P Series horns.

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U.S.
T 888-378-2329
F 866-503-3996

Canada
T 519 376 2430
F 519 376 7258

Asia
T 852 2907 8108
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F 61 3 9259 4799

Europe
T 32 2 725 11 20
F 32 2 721 86 13

Latin America
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F 305 593 4300

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Ordering Information

Catalog Number		Description	Ship Wt. lbs (kg)
White Finish	Red Finish		
G1-HDVM	G1R-HDVM	Genesis Horn-Strobe (selectable 15, 30, 75, or 110 cd output, selectable high/low dB output)	0.25 (0.11)
G1-VM	G1R-VM	Genesis Strobe (selectable 15, 30, 75, or 110 cd output)	
G1-HD	G1R-HD	Genesis Temporal Horn (selectable high/low dB output)	
G1-P	G1R-P	Genesis Steady Horn (not compatible with Genesis Signal Master)	
G1F-HDVM	G1RF-HDVM	Genesis Horn-Strobe (selectable 15, 30, 75, or 110 cd output, selectable high/low dB output) – with "FIRE" marking	
G1F-VM	G1RF-VM	Genesis Strobe (selectable 15, 30, 75, or 110 cd output) – with "FIRE" marking	
G1F-HD	G1RF-HD	Genesis Temporal Horn (selectable high/low dB output) – with "FIRE" marking	
G1F-P	G1RF-P	Genesis Steady Horn with "FIRE" marking (not compatible with Genesis Signal Master)	
G1F-HDV1575	G1RF-HDV1575	15/75 cd temporal horn-strobe, hi/lo dB-24V – with "FIRE" marking (see note 1)	
G1F-V1575	G1RF-V1575	15/75 cd strobe – with "FIRE" marking (see note 1)	
Mounting Accessories			
G1T	G1RT	Genesis Trim Plate (for two-gang or 4" square boxes)	0.15 (0.7)
G1T-FIRE	G1RT-FIRE	Genesis Trim Plate (for two-gang or 4" square boxes) with "FIRE" markings	0.15 (0.7)
27193-16	27193-11	One-gang surface mount box	1 (0.4)
Synchronization Modules			
G1M		Genesis Signal Master – Snap-on Mount	0.2 (0.1)
G1M-RM		Genesis Signal Master – Remote Mount (1-gang)	
SIGA-CC1S		Intelligent Synchronization Output Module (2-gang)	0.5 (0.23)
SIGA-MCC1S		Intelligent Synchronization Output Module (Plug-in UIO)	0.18 (0.08)

Note 1: These 15/75 cd models provide fixed output and are not multi-candela devices. The 15 cd output component complies with UL1971, while the 75 cd output component complies with UL 1638.

Genesis Horn-Strobes may be ordered in red or white, with or without 'FIRE' marking. Order matching trim plates separately.

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Overview

The GE Security *SuperDuct* Signature Series smoke detector is the most advanced and most reliable device in its class. Designed for easy installation and superb reliability, *SuperDuct* represents the perfect balance of practical design and advanced technology.

***SuperDuct* detectors** feature a unique design that speeds installation and simplifies maintenance. Removable dust filters, conformally coated circuit boards, and optional water-resistant gaskets keep contaminants away from components, ensuring years of trouble-free service. When cleaning is required, the assemblies come apart easily and snap back together in seconds.

A Signature Series photoelectric sensor is incorporated into the design of each SIGA-SD duct smoke detector. This sensor inherits the power and benefits of this exceptional line of intelligent devices.

Signature Series sensors gather analog information from their smoke sensing elements and convert it into digital signals. The sensor measures and analyses these signals and compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires, which virtually eliminates unwanted alarms.

WARNING: Duct detectors have specific limitations. Duct detectors are not a substitute for an open area smoke detector. Duct detectors are not a substitute for early warning detection or a replacement for a building's regular fire detection system. Smoke detectors are not designed to detect toxic gases which can build up to hazardous levels in some fires. These devices will not operate without electrical power. As fires frequently cause power interruptions, GE Security suggests you discuss further safeguards with your local fire protection specialist.

Standard Features

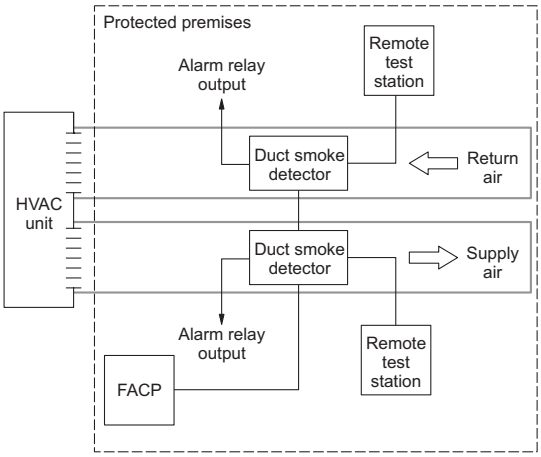
- Less than 2" deep for easy installation and applications where space is tight
- -20 to 158 °F (-29 to 70 °C) operating range with 100 ft/min. to 4,000 ft/min air velocity rating assures reliability under harsh environmental conditions
- Status LEDs remain visible through clear assembly cover
- Cover monitor switch for added security
- Standard sampling tube spacing for easy drop-in migration from other detectors
- Sampling tube can be installed with or without the cover in place and can be rotated in 45-degree increments to ensure proper alignment with duct airflow
- 15.2 to 19.95 Vdc operation
- Magnet-activated test switch
- One Form C auxiliary alarm relay for controlling ancillary equipment (e.g., HVAC controls)
- No special tools required for easy access to field connections
- Signature Series intelligence
- Environmental compensation with differential sensing for reliable, stable, and drift-free sensitivity
- Wide 0.79% to 2.46% obscuration/ft. smoke sensitivity
- Identification of dirty or defective detectors

Intelligent Duct Smoke Detector

SIGA-SD

Application

SuperDuct detectors are ideally suited to duct smoke detection applications where early indication of combustion is required within the confined space of ventilation ductwork. Its primary purpose is to provide early warning of an impending fire and to prevent smoke from circulating throughout the building. It is typically used to detect smoke in the supply side of the HVAC system but can provide supervision of the return side as well.



SuperDuct detectors continually sample air flow in the HVAC duct and initiate an alarm condition whenever smoke is detected. An alarm is activated when the quantity (percent obscuration) of combustion products in that air sample exceeds the detector's sensitivity setting.

Signature Series Intelligence

Like all Signature detectors, the SIGA-SD features electronic addressing and issues a dirty sensor warning when it reaches its preset limit. The dirty sensor warning indicates the sensor is operating within its specified limits but is in need of servicing. When the detector's ability to compensate for environmental changes has reached its limit, the duct smoke detector signals a trouble condition.

The SIGA-SD also uses differential sensing to prevent gradual environmental changes from triggering unwanted alarms. A rapid change in environmental conditions, such as smoke from a fire, causes the detector to signal an alarm state, but dust and debris accumulated over time does not change alarm sensitivity.

Each Signature Series SuperDuct detector contains a microprocessor that performs comprehensive self-diagnostics and stores the results in nonvolatile memory. Stored results include details such as hours of operation, last maintenance date, and number of alarms and troubles. This information can be retrieved and reviewed when desired.

Detector Configuration

The detector assembly cover provides easy access to the smoke sensor, its wiring connections, sample and exhaust tubes, and the smoke chamber itself.

Air enters the detector's sensing chamber through a sampling tube (ordered separately) that extends into the duct and is directed back into the ventilation system through an exhaust tube (included). The difference in air pressure between the two tubes pulls the sampled air through the sensing chamber. When a sufficient amount of smoke is detected in the sensing chamber, the detector initiates an alarm.

The sampling tube may be installed from either the duct side of the assembly or from inside the sensor compartment, as preferred by the installer. (The exhaust tube must be installed from the duct side.) Sampling tubes may be rotated in 45-degree increments so that air-holes can be aligned to allow the unit to be mounted at virtually any angle relative to the air flow.

In installations where the duct smoke detector's controls and indicators are hidden from view, a remote test station or an LED indicator can be connected to the detector to provide these functions.

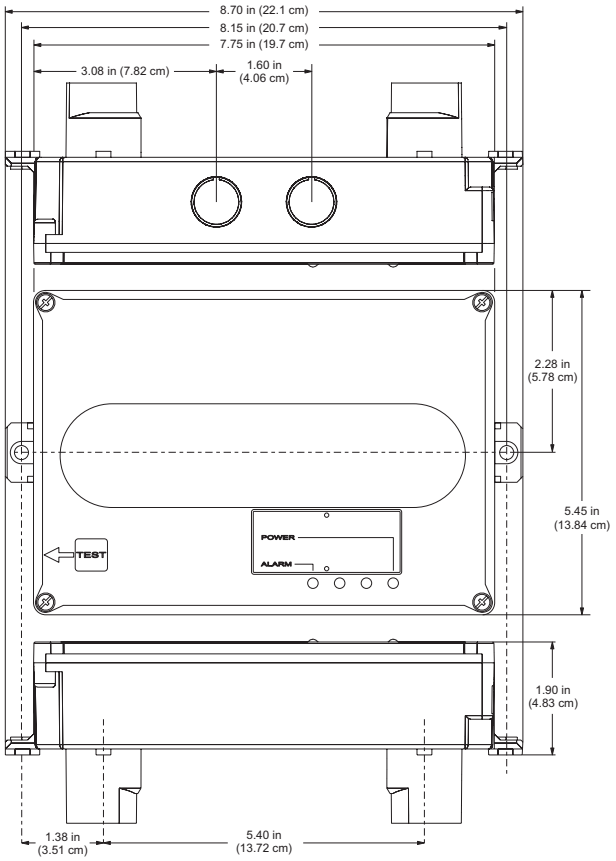
Remote Test Stations

Labor-saving Remote Test/Reset stations provide alarm testing from the convenience of a remote location. Tests can be performed quickly and safely – without having to climb to the roof. Magnetically-operated and key-operated one-gang models are available. Signature SuperDuct detectors are also compatible with SIGA-LED remote alarm LED.

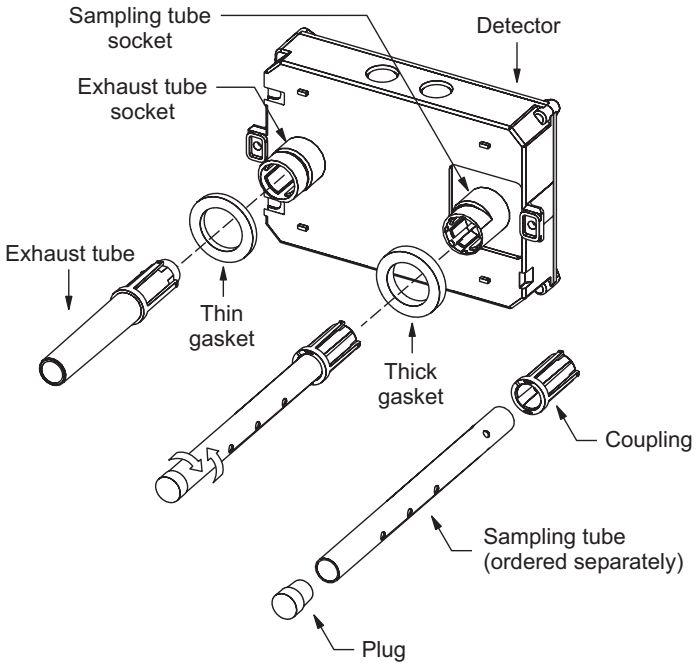
Air velocity in the duct as low as 100 ft/min. maintains adequate air flow into the sensor smoke chamber through air holes in the air sampling tube and discharges through the exhaust tube. *SuperDuct* air sampling tubes must be installed with the inlet holes facing the airstream. Sampling tubes may be rotated in 45-degree increments so that air-holes can be aligned to allow the unit to be mounted in virtually any angle relative to the airflow.

SuperDuct sensors are engineered to operate optimally under the harsh environmental conditions frequently found in HVAC ductwork. Nonetheless, before installing the detector, test the duct air velocity, temperature, and humidity to verify that it is within the operating range of the *SuperDuct* detector. Consult the *SuperDuct* installation sheet for details.

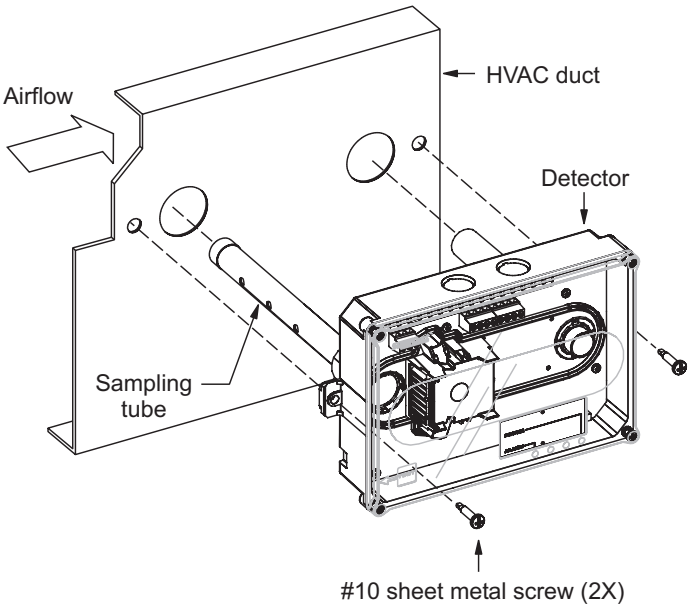
Dimensions



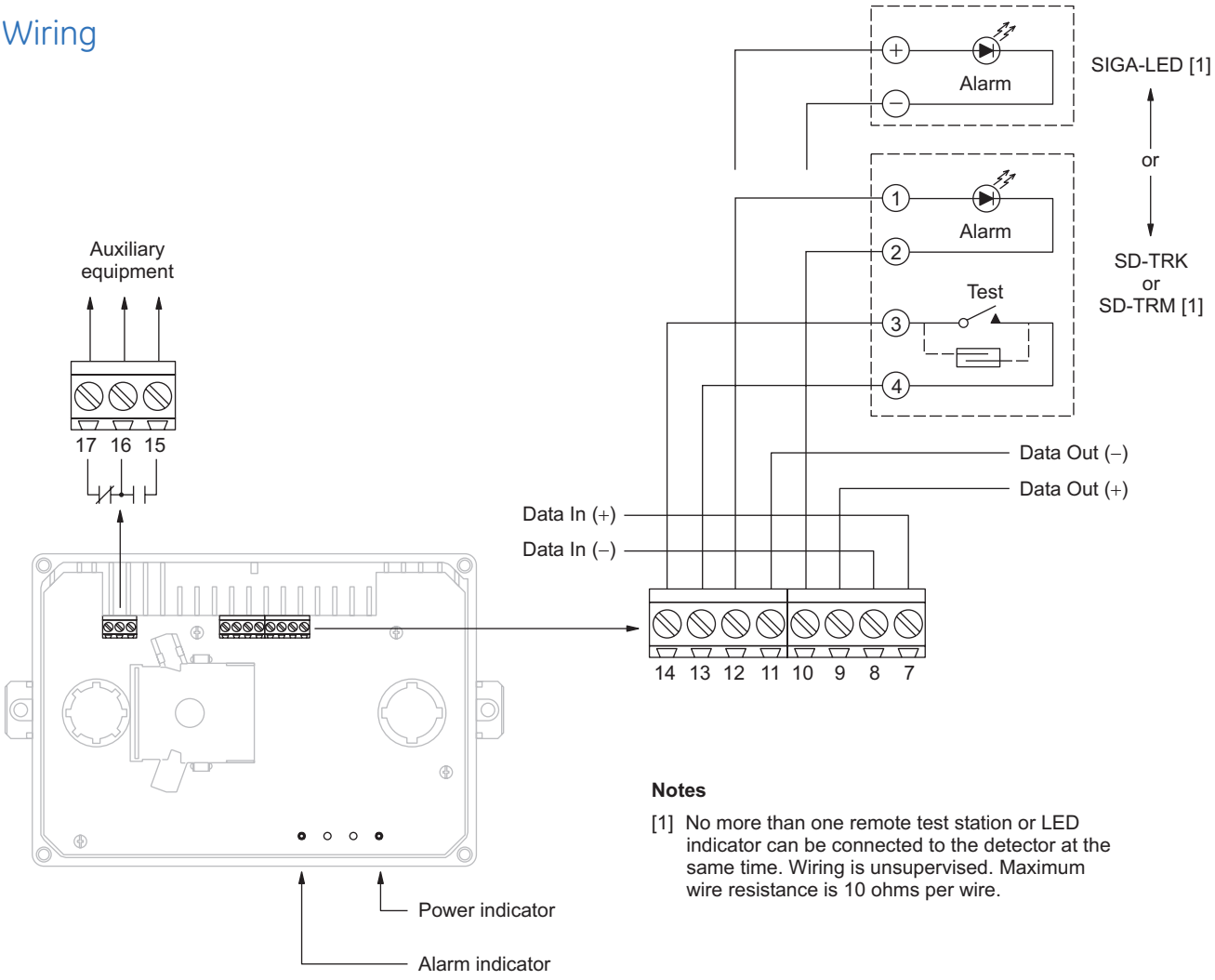
Assembly



Mounting



Wiring



Notes

[1] No more than one remote test station or LED indicator can be connected to the detector at the same time. Wiring is unsupervised. Maximum wire resistance is 10 ohms per wire.

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F 519 376 7258

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F 852 2142 5063

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F 61 3 9259 4799

Europe
T 32 2 725 11 20
F 32 2 721 86 13

Latin America
T 305 593 4301
F 305 593 4300

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Specifications, detector

Dimensions	8.70 x 5.45 x 1.90 inches (221 x 138 x 48 mm)
Wire size	14 to 22 AWG
Smoke detection method	Photoelectric (light scattering principle)
Air velocity rating	100 to 4,000 ft/min
Air pressure differential	0.005 to 1.00 inches of water
Sensitivity	0.79 to 2.46 %/ft obscuration
Alarm test response time	5 seconds
LED indicators	Alarm (red), Power (green)
Common alarm relay	Unsupervised and power-limited Quantity: 1 Type: Form C Ratings: 2.0 A at 30 Vdc (resistive)
Operating voltage	15.2 to 19.95 Vdc
Operating current	Standby: 45 µA Alarm: 45 µA Inrush: 1 mA Standalone alarm: 18 mA
Operating environment	Temperature: -20 to 158 °F (-29 to 70 °C) Humidity 93% RH, noncondensing
Agency listings	UL, ULC, CSFM, FM, MEA

Specifications, test stations

Remote Test/Reset Stations provide alarm test, trouble indication, and reset capability from a remote location. They include a one-gang plate, momentary SPST switch, red alarm LED, and terminal block. Magnetically-operated models (TRM) or key-operated models (TRK) are available.

Compatible electrical boxes	North American 1-gang box Standard 4-in square box, 1-1/2 inches deep, with 1-gang cover
LED indicators	Alarm (red)
LED type	Clear lens
Wire size	14 to 22 AWG
Resistance per wire	10 Ohms, max.
Current requirements	See controller specifications
LED circuit ratings	Voltage: 3 Vdc, max. Current: 30 mA, max.
Switch ratings (SD-TRK)	Voltage: 125 Vdc, max. Current: 4 A, max.
Switch ratings (SD-TRM)	Voltage: 200 Vdc, max. Current: 0.5 A, max.
Compatible detectors	SuperDuct conventional two-wire and Signature duct smoke detectors
Operating environment	Temperature: 32 to 131 °F (0 to 55 °C) Humidity: 93% RH, noncondensing
Storage temperature	-4 to 140 °F (-20 to 60 °C)
Agency listings	UL, ULC, CSFM

Ordering Information

Catalog Number	Description	Ship Wt., lb. (kg)
SIGA-SD	Intelligent SuperDuct Detector	2.4 (1.1)
Accessories		
SD-T8	8-inch sampling tube	0.5 (0.2)
SD-T18	18-inch sampling tube	1.5 (0.7)
SD-T24	24-inch sampling tube	2.7 (1.2)
SD-T36	36-inch sampling tube	3.0 (1.4)
SD-T42	42-inch sampling tube	3.5 (1.6)
SD-T60	60-inch sampling tube	5.8 (2.6)
SD-T78	78-inch sampling tube	7.5 (3.4)
SD-T120	120-inch sampling tube	11.5 (5.2)
SIGA-LED	Remote alarm LED	1.0 (0.5)
SD-TRM	Remote test station, magnetic	1.0 (0.5)
SD-TRK	Remote test station, keyed	1.0 (0.5)
SD-VTK	Air velocity test kit (stoppers only, etc)	1.0 (0.5)
SD-GSK	Cover gasket kit	0.5 (0.2)
SD-MAG	Test magnet kit	0.5 (0.2)
SIGA-SDPCB	Replacement PCB/Signature sensor kit	1.0 (0.5)

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Overview

The Signature Series Model SIGA-PS Intelligent Photoelectric Smoke Detector gathers analog information from its smoke sensing element and converts it into digital signals. The detector's on-board microprocessor measures and analyzes these signals. It compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires. Unwanted alarms are virtually eliminated.

The microprocessor in each detector provides four additional benefits - Self-diagnostics and History Log, Automatic Device Mapping, Stand-alone Operation and Fast, Stable Communication.

Self-diagnostics and History Log - Each Signature Series detector constantly runs self-checks to provide important maintenance information. The results of the self-check are automatically updated and permanently stored in the detector's non-volatile memory

Automatic Device Mapping - The loop controller learns where each device's serial number address is installed relative to other devices on the circuit. The mapping feature provides supervision of each device's installed location to prevent a detector from being reinstalled (after cleaning etc.) in a different location from where it was originally.

Stand-alone Operation - A decentralized alarm decision by the detector is guaranteed. On-board intelligence permits the detector to operate in stand-alone mode. If loop controller CPU communications fail for more than four seconds, all devices on that circuit go into stand-alone mode. The circuit acts like a conventional alarm receiving circuit.

Fast Stable Communication - On-board intelligence means less information needs to be sent between the detector and the loop controller. Other than regular supervisory polling response, the detector only needs to communicate with the loop controller when it has something new to report.

Standard Features

- Integral microprocessor
- Non-volatile memory
- Automatic mapping device
- Electronic addressing
- Environmental compensation
- Intelligent detector
- Wide 0.67% to 3.77%/ft. sensitivity range
- Twenty pre-alarm sensitivity values, set in 5% increments
- Identification of dirty or defective detectors
- Automatic day/night sensitivity adjustment
- Twin RED/GREEN status LEDs
- Standard, relay, fault isolator, and audible mounting bases
- Designed and manufactured to ISO 9001 standards

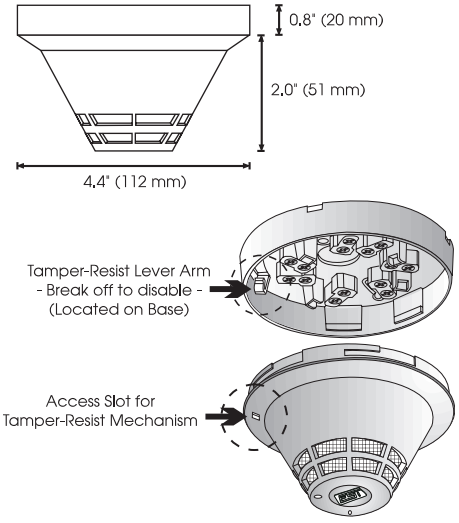
Intelligent Photoelectric Smoke Detector

SIGA-PS

Application Notes Available

Installation

Signature Series detectors mount to North American 1-gang boxes, 3-1/2 inch or 4 inch octagon boxes, and to 4 inch square electrical boxes 1-1/2 inches (38 mm) deep. They mount to European BESA and 1-gang boxes with 60.3 mm fixing centers.



Testing & Maintenance

Each detector automatically identifies when it is dirty or defective and causes a "dirty detector" message. The detector's sensitivity measurement can also be transmitted to the loop controller. A sensitivity report can be printed to satisfy NFPA sensitivity measurements which must be conducted at the end of the first year and every two years thereafter.

The user-friendly maintenance program shows the current state of each detector and other pertinent messages. Single detectors may be turned off temporarily from the control panel. Availability of maintenance features is dependent on the fire alarm system used. Scheduled maintenance (Regular or Selected) for proper detector operation should be planned to meet the requirements of the Authority Having Jurisdiction (AHJ). Refer to current NFPA 72 and ULC CAN/ULC 536 standards.

Compatibility

The SIGA-PS detectors are compatible only with the Signature Loop Controller.

Warnings & Cautions

This detector will not operate without electrical power. As fires frequently cause power interruption, we suggest you discuss further safeguards with your fire protection specialist.

This detector will NOT sense fires that start in areas where smoke cannot reach the detector. Smoke from fires in walls, roofs, or on the opposite side of closed doors may not reach the detector to alarm it.

Accessories

All detector mounting bases have wiring terminals that are accessible from the "room-side" after mounting the base to the electrical box. The bases mount to North American 1-gang boxes and to 3½ inch or 4 inch octagon boxes, 1½ inches (38 mm) deep. They also mount to European BESA and 1-gang boxes with 60.3 mm fixing centers. The SIGA-SB4, SIGA-RB4, and SIGA-IB4 mount to North American 4 inch sq. electrical boxes in addition to the above boxes. They include the SIGA-TS4 Trim Skirt which is used to cover the "mounting ears" on the base. The SIGA-AB4G mounts to a 4" sqare box only.

SIGA-AB4G
Audible Base

SIGA-SB
Standard Base

SIGA-IB
Isolator Base

SIGA-RB
Relay Base

SIGA-LED
Remote LED

Standard Base SIGA-SB, SIGA-SB4 - This is the basic mounting base for GE Security Signature Series detectors. The SIGA-LED Remote LED is supported by the Standard Base.

Relay Base SIGA-RB, SIGA-RB4 - This base includes a relay. Normally open or closed operation is selected during installation. The dry contact is rated for 1 amp (pilot duty) @ 30 Vdc. The relay's position is supervised to avoid accidentally jarring it out of position. The SIGA-RB can be operated as a control relay if programmed to do so at the control panel (EST3 V.2 only). The relay base does not support the SIGA-LED Remote LED.

Audible Base SIGA-AB4G - This base is designed for use where localized or group alarm signaling is required. When the detector senses an alarm condition, the audible base emits a local alarm signal. The optional SIGA-CRR Polarity Reversal Relay can be used for sounding to other audible bases on the same 24 Vdc circuit.

Relay and Audible Bases operate as follows:

- at system power-up or reset, the relay is de-energized
- when a detector is installed in the base with the power on, the relay energizes for four seconds, then de-energizes
- when a detector is removed from a base with the power on, the relay is de-energized
- when the detector enters the alarm state, the relay is energized.

Isolator Base SIGA-IB, SIGA-IB4 - This base includes a built-in line fault isolator for use on Class A circuits. A detector must be installed for it to operate. The isolator base does not support the SIGA-LED Remote LED.

The isolator operates as follows:

- a short on the line causes all isolators to open within 23 msec
- at 10 msec intervals, beginning on one side of the Class A circuit nearest the loop controller, the isolators close to provide the next isolator down the line with power
- when the isolator next to the short closes, reopens within 10 msec.

The process repeats beginning on the other side of the loop controller.

Remote LED SIGA-LED - The remote LED connects to the SIGA-SB or SIGA-SB4 Standard Base only. It features a North American size 1-gang plastic faceplate with a white finish and red alarm LED.

SIGA-TS4 Trim Skirt - Supplied with 4 inch bases, it can also be ordered separately to use with the other bases to help hide surface imperfections not covered by the smaller bases.

Application

Although photoelectric detectors have a wide range of fire sensing capabilities they are best suited for detecting slow, smoldering fires. The table below shows six standard test fires used to rate the sensitivity of smoke and heat detectors. The table indicates that no single sensing element is suited for all test fires.

GE Security recommends that this detector be installed according to latest recognized edition of national and local fire alarm codes.

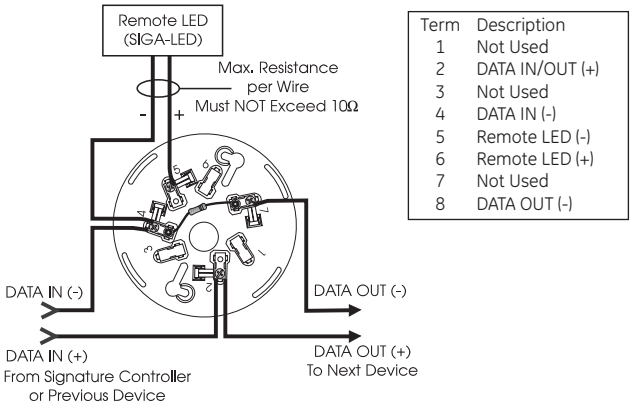
Test Fire	SIGA-IS Ion	SIGA-PS Photo	SIGA-HRS and SIGA-HFS Rate-of-Rise/ Fixed Temp.	SIGA-PHS Photo Heat 3D	SIGA-IPHS Ion/Photo/Heat 4D
Open Wood	**optimum**	unsuitable	**optimum**	very suitable	**optimum**
Wood Pyrolysis	suitable	**optimum**	unsuitable	**optimum**	**optimum**
Smouldering Cotton	very suitable	**optimum**	unsuitable	**optimum**	**optimum**
Poly Urethane Foam	very suitable	very suitable	suitable	very suitable	**optimum**
n-Heptane	**optimum**	very suitable	very suitable	**optimum**	**optimum**
Liquid Fire without Smoke	unsuitable	unsuitable	**optimum**	very suitable	very suitable

Typical Wiring

The detector mounting bases accept #18 AWG (0.75mm^2), #16 (1.0mm^2), #14 AWG (1.5mm^2), and #12 AWG (2.5mm^2) wire sizes.

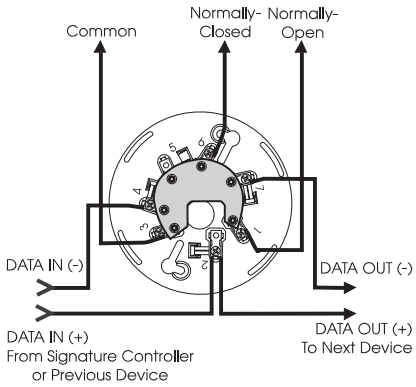
Note: Sizes #16 AWG (1.0mm^2) and #18 AWG (0.75mm^2) are preferred for ease of installation. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.

Standard Detector Base, SIGA-SB, SIGA-SB4



Term	Description
1	Not Used
2	DATA IN/OUT (+)
3	Not Used
4	DATA IN (-)
5	Remote LED (-)
6	Remote LED (+)
7	Not Used
8	DATA OUT (-)

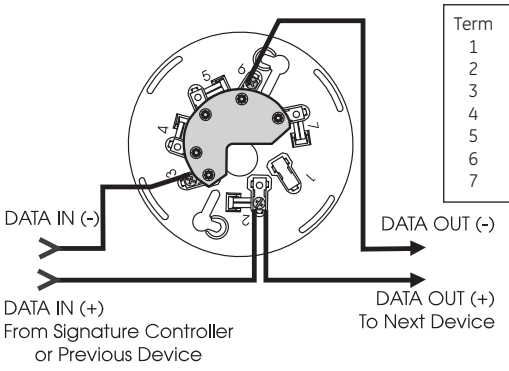
Relay Detector Base, SIGA-RB, SIGA-RB4



Term	Description
1	Normally Open
2	DATA IN/OUT (+)
3	Common
4	DATA IN (-)
5	Not Used
6	Normally-Closed
7	DATA OUT (-)

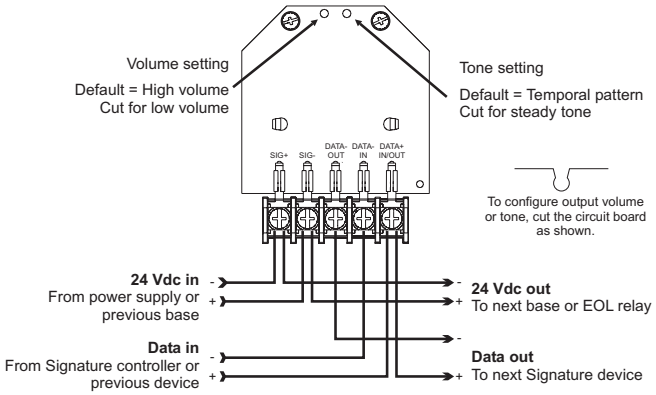
CONTACT RATING
1.0 Amp @ 30 VDC
(Pilot Duty)

Isolator Detector Base, SIGA-IB, SIGA-IB4



Term	Description
1	Not Used
2	DATA IN/OUT (+)
3	DATA IN (-)
4	Not Used
5	Not Used
6	DATA OUT (-)
7	Not Used

Audible Detector Base, SIGA-AB4G



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T 519 376 2430
F 519 376 7258

Asia
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F 852 2142 5063

Australia
T 61 3 9259 4700
F 61 3 9259 4799

Europe
T 32 2 725 11 20
F 32 2 721 86 13

Latin America
T 305 593 4301
F 305 593 4300

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Specifications

Sensing Element	Photoelectric - Light Scattering Principle
Storage & Operating Environment	Air Velocity Range: 0 to 5,000 ft/min (0 to 25.39 m/s); Humidity: 0 to 93% RH, Non-Condensing Operating Temp: 32°F to 120°F (0°C to 49°C); Storage Temp: -4°F to 140°F (-20°Cto 60°C)
Sensitivity Range	ULI/ULC - 0.67% to 3.77% obscuration/foot
User Selected Alarm Sensitivity Settings	Most Sensitive: 1.0%/ft.; More Sensitive: 2.0%/ft.; Normal: 2.5%/ft.; Less Sensitive: 3.0%/ft.; Least Sensitive: 3.5%/ft.
Pre-alarm Sensitivity	5% increments, allowing up to 20 pre-alarm settings
Operating Voltage	15.2 to 19.95 Vdc (19 Vdc nominal)
Operating Current	Quiescent: 45µA @ 19 V; Alarm: 45µA @ 19 V Emergency Stand-alone Alarm Mode: 18mA Pulse Current: 100 µA (100 msec); During Communication: 9 mA max.
Construction & Finish	High Impact Engineering Polymer - White
Compatible Mounting Bases	SIGA-SB Standard Base, SIGA-RB Relay Base, SIGA-IB Isolator Base, SIGA-AB4, SIGA-AB4G Audible Bases
LED Operation	On-board Green LED - Flashes when polled; On-board Red LED - Flashes when in alarm Both LEDs - Glow steady when in alarm (stand-alone) Compatible Remote Red LED (model SIGA-LED) Flashes when in alarm
Compatibility	Use With: SIGNATURE Loop Controller
Address Requirements	Uses one Device Address
Agency Listings	UL, ULC, MEA, CSFM
UL Listed Spacing	30 ft

Ordering Information

Catalog Number	Description	Ship Wt. lbs (kg)
SIGA-PS	Intelligent Photoelectric Detector - UL/ULC Listed	0.5 (.23)
Accessories		
SIGA-SB	Detector Mounting Base - Standard	0.2 (.09)
SIGA-SB4	4-inch Detector Mounting Base c/w SIGA-TS4 Trim Skirt	
SIGA-RB	Detector Mounting Base w/Relay	
SIGA-RB4	4-inch Detector Mounting Base w/Relay, c/w SIGA-TS4 Trim Skirt	
SIGA-IB	Detector Mounting Base w/Fault Isolator	
SIGA-IB4	4-inch Detector Mounting Base w/ Fault Isolator, c/w SIGA-TS4 Trim Skirt	
SIGA-LED	Remote Alarm LED	
SIGA-AB4G	Audible (Sounder) Base	.3 (0.15)
SIGA-TS4	Trim Skirt (supplied with 4-inch bases)	.1 (.04)

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APPENDIX H
HYDRAULIC CALCULATIONS

REMOTE AREA CALCULATIONS

Basement – Area A

A_s= S x L = 13 x 10 = 130 sqft.
Q_s = A_s x D = 130 sqft x 0.2 gpm/sqft = 26 gpm
Per NFPA13: 23.4.4.1.1.1, the remote area is
L = 1.2 x √A = 1.2 x 1500 = 46.5ft by 32.2ft
A / A_s = 1500 / 130 = 11.5 rounded up to 12

Ground Floor – A. Café

Area reduction
y=-3x/2 + 55 = -3(18)/2 + 55 = 28% reduction in area
1500(72%) = 1080 square feet
A_s= S x L = 10 x 13 = 130 sqft.
Q_s = A_s x D = 130 sqft x 0.2 gpm/sqft = 26 gpm
Per NFPA13: 23.4.4.1.1.1, the remote area is
L = 1.2 x √A = 1.2 x 1080 = 39.4ft x 27.4ft
A / A_s = 1080 / 130 = 8.3 rounded up to 9

Ground Floor – D. Main Assembly

y=-3x/2 + 55 = -3(18)/2 + 55 = 28% reduction in area
1500(72%) = 1080 square feet

A_s= S x L = 12 x 12 = 144 sqft.
Q_s = A_s x D = 144 sqft x 0.1 gpm/sqft = 14.4 gpm
Per NFPA13: 23.4.4.1.1.1, the remote area is
L = 1.2 x √A = 1.2 x 1080 = 39.4ft x 27.4ft
A / A_s = 1080 / 130 = 8.3 rounded up to 9

Ground Floor – E. Mercantile

y=-3x/2 + 55 = -3(18)/2 + 55 = 28% reduction in area
1500(72%) = 1080 square feet
TYCO PENDANT QUICK RESPONSE (TY4231) Standard Spray K8.0/155˚ F
A_s= S x L = 11 x 11.5 = 126 sqft.
Q_s = A_s x D = 126 sqft x 0.2 gpm/sqft = 25.2 gpm
Per NFPA13: 23.4.4.1.1.1, the remote area is
L = 1.2 x √A = 1.2 x 1080 = 39.4ft x 27.4ft
A / A_s = 1080 / 130 = 8.3 rounded up to 9

i. **Ground Floor – F. Coffee Shop**

y=-3x/2 + 55 = -3(18)/2 + 55 = 28% reduction in area
1500(72%) = 1080 square feet

TYCO PENDANT QUICK RESPONSE (TY4231) Standard Spray K8.0/155˚ F
A_s= S x L = 10 x 13 = 130 sqft.
$Q_s = A_s$ x D = 130 sqft x 0.2 gpm/sqft = 26 gpm
Per NFPA13: 23.4.4.1.1.1, the remote area is
L = 1.2 x √A = 1.2 x 1080 = 39.4ft x 27.4ft
A / A_s = 1080 / 130 = 8.3 rounded up to 9

ii. Ground Floor – Dormitory Tower 1

TYCO PENDANT (TY3231) QUICK RESPONSE Standard Spray K5.6/155˚ F
TYCO PENDANT (TY4231) QUICK RESPONSE Standard Spray K8.0/155˚ F

For the dorm room, the room area was utilized as the design area.
A_s= S x L = 12 x 12 = 144 sqft. (largest)
A_s= Room = 5 x 8 = 40 sqft. (bathroom/kitchen/corridor)
$Q_s = A_s$ x D = 144 sqft x 0.1 gpm/sqft = 14.4 gpm

iii. Ground Floor – Dormitory Tower 2

TYCO PENDANT (TY3231) Standard Spray K5.6/155˚ F
TYCO PENDANT (TY4231) QUICK RESPONSE Standard Spray K8.0/155˚ F
A_s= S x L = 12 x 12 = 144 sqft. (largest)
A_s= Room = 5 x 8 = 40 sqft. (bathroom/kitchen/corridor)
$Q_s = A_s$ x D = 144 sqft x 0.1 gpm/sqft = 28.8gpm
Per NFPA13: 23.4.4.1.1.1, the remote area is based on one dorm room plus five sprinklers in the corridor.

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WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	@ FLOW (GPM)	AVAIL. PRESS. (PSI)	@ TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	60.0	50.0	1500.0	57.6	688.6	20.0

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	688.6 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	438.6 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
1	-2.0	K= 8.00	10.6	26.0
2	-2.0	K= 8.00	13.3	29.2
3	-2.0	K= 8.00	15.8	31.8
4	-2.0	K= 8.00	17.2	33.2
5	-2.0	K= 8.00	16.0	32.0
6	-2.0	- - - -	19.9	- - -
7	-2.0	K= 8.00	14.0	29.9
8	-2.0	K= 8.00	17.0	33.0
9	-2.0	K= 8.00	21.8	37.4
10	-2.0	K= 8.00	18.8	34.7
11	-2.0	K= 8.00	15.5	31.5
12	-2.0	- - - -	23.2	- - -
13	-2.0	K= 8.00	19.7	35.5
14	-2.0	K= 8.00	25.7	40.5
15	-2.0	K= 8.00	30.1	43.9
16	-2.0	- - - -	32.0	- - -
17	-2.0	- - - -	68.9	- - -
18	-2.0	- - - -	70.6	- - -
19	2.0	- - - -	71.2	- - -
PI	2.0	- - - -	15.6	- - -
PO	2.0	- - - -	71.3	- - -
TOR	12.0	- - - -	66.3	- - -
BOR	3.0	- - - -	70.4	- - -
SOURCE	-8.0	SOURCE	20.0	438.6

PIPE DATA

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 1					-26.0	1.049 PL	11.00	PF	2.7
1	-2.0	8.0	10.6	26.0	9.7	120 FTG	E	PE	0.0
2	-2.0	8.0	13.3	29.2		0.211 TL	13.00	PV	
Pipe: 2					-55.2	1.380 PL	11.00	PF	2.5
2	-2.0	8.0	13.3	29.2	11.8	120 FTG	----	PE	0.0
3	-2.0	8.0	15.8	31.8		0.224 TL	11.00	PV	
Pipe: 3					-87.0	1.380 PL	2.00	PF	4.2
3	-2.0	8.0	15.8	31.8	18.7	120 FTG	T	PE	0.0
6	-2.0	0.0	19.9	0.0		0.519 TL	8.00	PV	
Pipe: 4					-32.0	1.380 PL	11.00	PF	1.1
5	-2.0	8.0	16.0	32.0	6.9	120 FTG	E	PE	0.0
4	-2.0	8.0	17.2	33.2		0.082 TL	14.00	PV	
Pipe: 5					-65.2	1.380 PL	9.00	PF	2.7
4	-2.0	8.0	17.2	33.2	14.0	120 FTG	----	PE	0.0
6	-2.0	0.0	19.9	0.0		0.305 TL	9.00	PV	
Pipe: 6					-152.2	2.067 PL	11.00	PF	3.3
6	-2.0	0.0	19.9	0.0	14.5	120 FTG	E	PE	0.0
12	-2.0	0.0	23.2	0.0		0.204 TL	16.00	PV	
Pipe: 7					-29.9	1.049 PL	11.00	PF	3.0
7	-2.0	8.0	14.0	29.9	11.1	120 FTG	----	PE	0.0
8	-2.0	8.0	17.0	33.0		0.274 TL	11.00	PV	
Pipe: 8					-62.9	1.380 PL	11.00	PF	4.8
8	-2.0	8.0	17.0	33.0	13.5	120 FTG	T	PE	0.0
9	-2.0	8.0	21.8	37.4		0.285 TL	17.00	PV	
Pipe: 9					-100.3	1.380 PL	2.00	PF	1.4
9	-2.0	8.0	21.8	37.4	21.5	120 FTG	----	PE	0.0
12	-2.0	0.0	23.2	0.0		0.676 TL	2.00	PV	
Pipe: 10					-31.5	1.049 PL	11.00	PF	3.3
11	-2.0	8.0	15.5	31.5	11.7	120 FTG	----	PE	0.0
10	-2.0	8.0	18.8	34.7		0.301 TL	11.00	PV	
Pipe: 11					-66.2	1.380 PL	11.00	PF	4.4
10	-2.0	8.0	18.8	34.7	14.2	120 FTG	E	PE	0.0
12	-2.0	0.0	23.2	0.0		0.313 TL	14.00	PV	
Pipe: 12					-318.6	2.067 PL	11.00	PF	8.8
12	-2.0	0.0	23.2	0.0	30.5	120 FTG	----	PE	0.0
16	-2.0	0.0	32.0	0.0		0.802 TL	11.00	PV	

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PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 13					-35.5	1.049 PL	11.00	PF	6.0
13	-2.0	8.0	19.7	35.5	13.2	120 FTG	T	PE	0.0
14	-2.0	8.0	25.7	40.5		0.376 TL	16.00	PV	
Pipe: 14					-76.0	1.380 PL	11.00	PF	4.5
14	-2.0	8.0	25.7	40.5	16.3	120 FTG	----	PE	0.0
15	-2.0	8.0	30.1	43.9		0.405 TL	11.00	PV	
Pipe: 15					-119.9	1.380 PL	2.00	PF	1.9
15	-2.0	8.0	30.1	43.9	25.7	120 FTG	----	PE	0.0
16	-2.0	0.0	32.0	0.0		0.941 TL	2.00	PV	
Pipe: 16					-438.6	2.067 PL	15.50	PF	36.9
16	-2.0	0.0	32.0	0.0	41.9	120 FTG	2E	PE	0.0
17	-2.0	0.0	68.9	0.0		1.448 TL	25.50	PV	
Pipe: 17					-438.6	4.260 PL	40.00	PF	1.7
17	-2.0	0.0	68.9	0.0	9.9	120 FTG	----	PE	0.0
18	-2.0	0.0	70.6	0.0		0.043 TL	40.00	PV	
Pipe: 18					-438.6	4.260 PL	14.00	PF	1.7
18	-2.0	0.0	70.6	0.0	9.9	120 FTG	2E	PE	-6.1
TOR	12.0	0.0	66.3	0.0		0.043 TL	40.00	PV	
Pipe: 19					-438.6	6.357 PL	10.00	PF	0.2
TOR	12.0	0.0	66.3	0.0	4.4	120 FTG	EB	PE	3.9
BOR	3.0	0.0	70.4	0.0		0.006 TL	41.00	PV	
Pipe: 20					-438.6	6.357 PL	10.00	PF	0.3
BOR	3.0	0.0	70.4	0.0	4.4	120 FTG	T	PE	0.4
19	2.0	0.0	71.2	0.0		0.006 TL	48.00	PV	
Pipe: 21					438.6	8.249 PL	10.00	PF	0.1
PO	2.0	0.0	71.3	0.0	2.6	120 FTG	C	PE	0.0
19	2.0	0.0	71.2	0.0		0.002 TL	63.00	PV	
Pipe: 22			FIRE PUMP			Rating: 1000.0 gpm @ 100.0 psi			
PI	2.0	0.0	15.6	0.0		Avail.: 438.5 gpm @ 101.1 psi			
PO	2.0	0.0	71.3	0.0		Req'd.: 438.5 gpm @ 55.7 psi			
User Defined Pump Curve:			gpm	psi		gpm	psi		
			0.0	102.0		1250.0	85.0		
			500.0	101.0		1500.0	65.0		
			1000.0	100.0					
Pipe: 23					-438.6	8.249 PL	50.00	PF	0.1
PI	2.0	0.0	15.6	0.0	2.6	120 FTG	G	PE	4.3
SOURCE	-8.0	SRCE	20.0	(N/A)		0.002 TL	55.00	PV	

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NOTES (HASS):

(1) Calculations were performed by the HASS 8.5 computer program
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Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average
imbalance at each node of 0.005 gpm and a maximum
imbalance at any node of 0.054 gpm.

(3) Total pressure at each node is used in balancing the system.
Maximum water velocity is 41.9 ft/sec at pipe 16.

(4) The Minimum pump suction pressure under maximum
calculated demand is 15.57 (psi)

(5) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(6) Available pressure at source node SOURCE under full flow conditions is
56.10 psi compared to the minimum required pressure of 20.00 psi.

(7) PIPE FITTINGS TABLE

Pipe Table Name: STANDARD.PIP

PAGE: A MATERIAL: S40 HWC: 120

Diameter	Equivalent Fitting Lengths in Feet								
(in)	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
1.049	2.00	5.00	2.00	5.00	6.00	1.00	10.00	2.00	5.00
1.380	3.00	6.00	2.00	7.00	6.00	1.00	10.00	10.00	6.00
2.067	5.00	10.00	3.00	11.00	6.00	1.00	10.00	10.00	10.00

PAGE: B MATERIAL: THNWL HWC: 120

Diameter	Equivalent Fitting Lengths in Feet								
(in)	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
4.260	13.00	26.00	8.00	29.00	16.00	3.00	26.00	26.00	26.00
6.357	18.00	38.00	11.00	40.00	13.00	4.00	35.00	35.00	38.00
8.249	21.00	41.00	15.00	53.00	14.00	5.00	37.00	37.00	41.00

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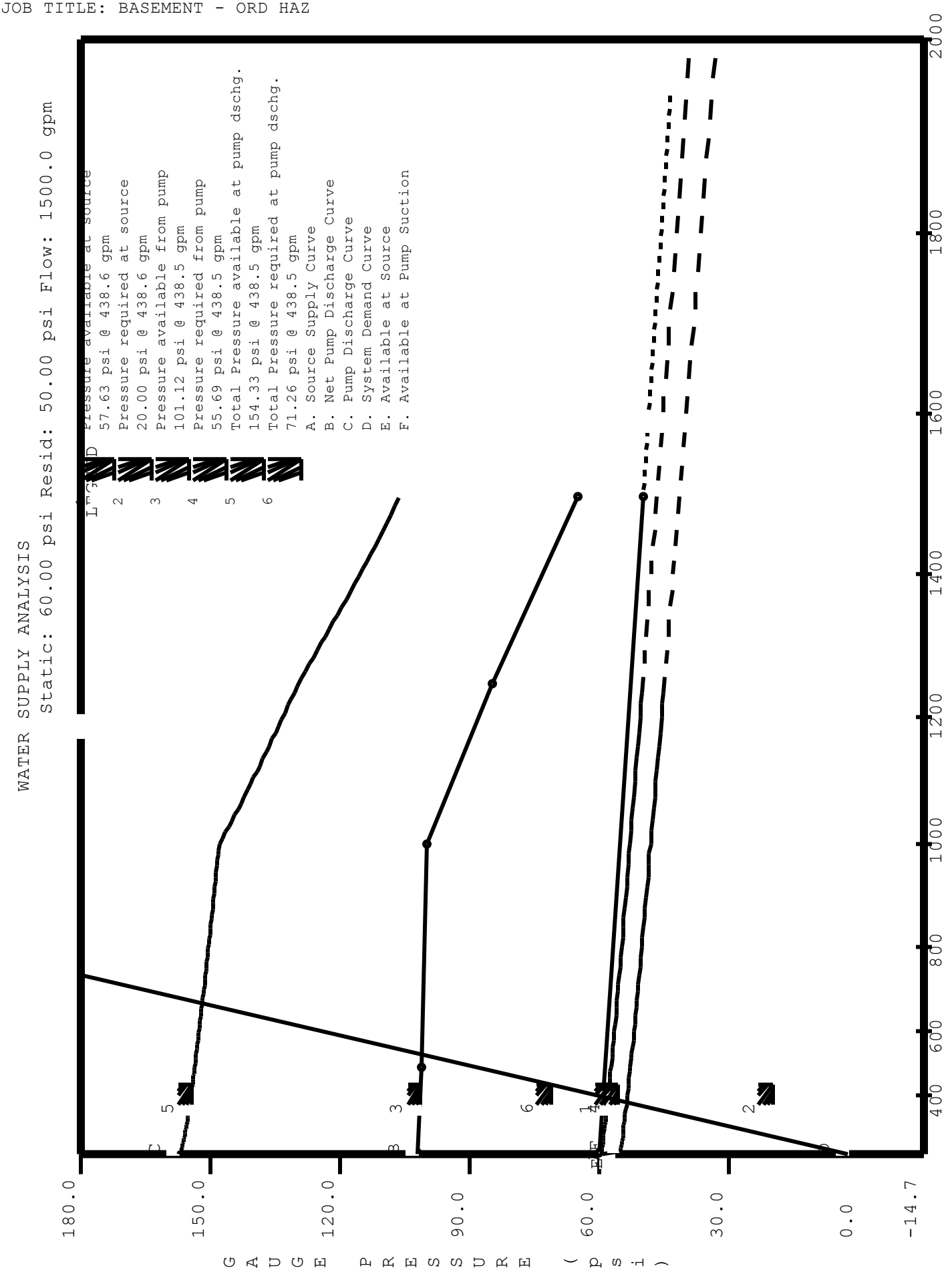

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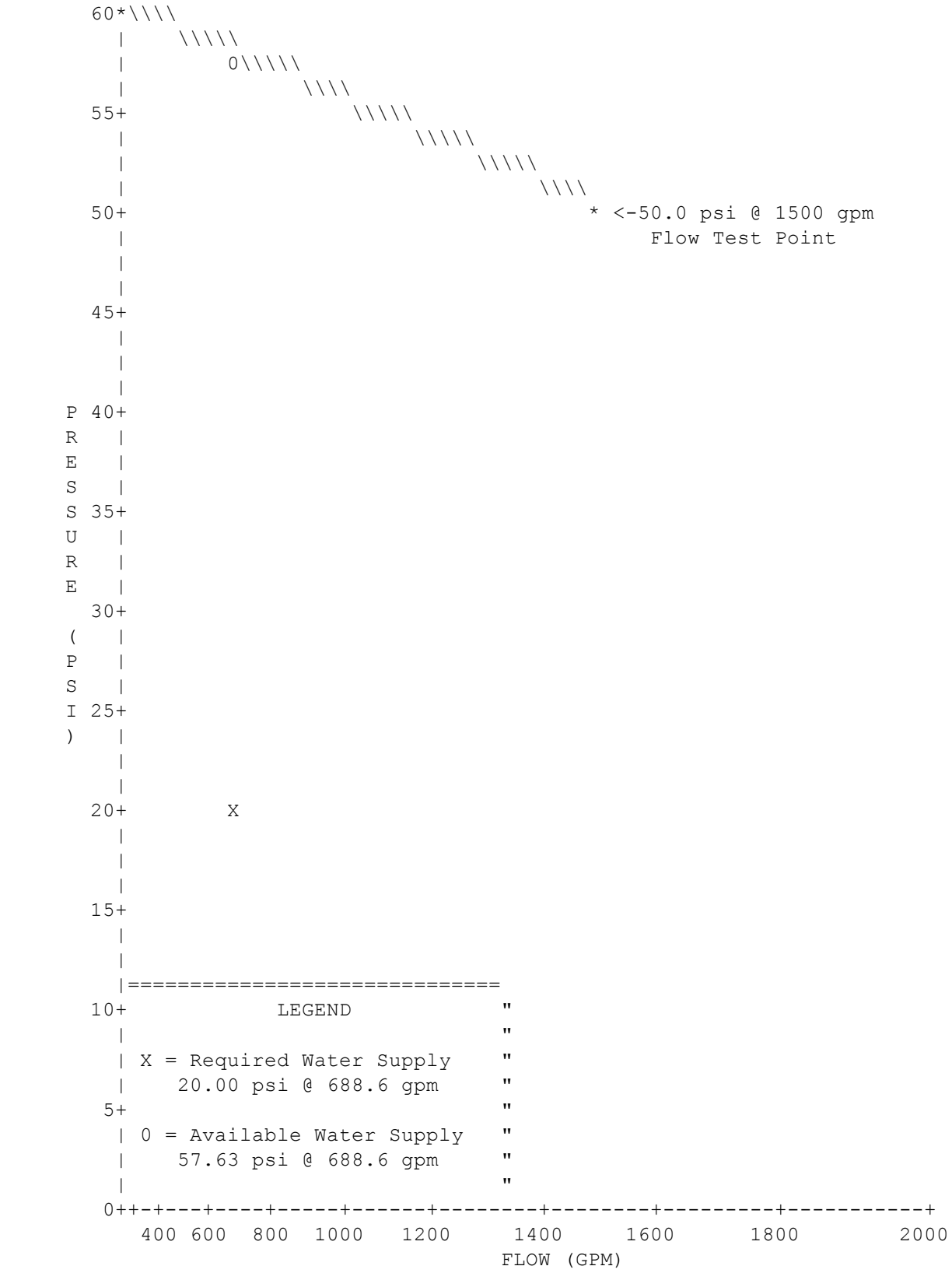
WATER SUPPLY CURVE



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WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. @ (PSI)	FLOW (GPM)	AVAIL. PRESS. @ (PSI)	TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	60.0	50.0	1500.0	57.1	764.8	20.0

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	764.8 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	250.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	264.8 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
1	17.6	K= 5.60	21.6	26.0
2	17.6	K= 5.60	24.1	27.5
3	17.6	K= 5.60	27.5	29.4
4	17.6	K= 5.60	32.2	31.8
5	17.0	- - - -	33.3	- - -
6	17.6	K= 5.60	22.6	26.6
7	17.6	K= 5.60	25.3	28.1
8	17.6	K= 5.60	28.8	30.0
9	17.6	K= 5.60	33.7	32.5
10	17.0	- - - -	34.9	- - -
11	17.6	K= 5.60	34.2	32.8
11A	17.0	- - - -	38.4	- - -
12	17.0	- - - -	40.7	- - -
13	17.0	- - - -	41.1	- - -
14	17.0	- - - -	41.2	- - -
15	-5.0	- - - -	18.6	- - -
TOR	8.0	- - - -	45.1	- - -
BOR	2.0	- - - -	47.8	- - -
PI	2.0	- - - -	15.6	- - -
PO	2.0	- - - -	47.9	- - -
HS	4.0	HOSE STREAM	14.8	250.0
SOURCE	-8.0	SOURCE	20.0	514.8

PIPE DATA

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)		PRESS. SUM. (PSI)	
Pipe: 1					-26.0	1.049	PL	10.00	PF	2.5
1	17.6	5.6	21.6	26.0	9.7	120	FTG	E	PE	0.0
2	17.6	5.6	24.1	27.5		0.211	TL	12.00	PV	
Pipe: 2					-53.5	1.380	PL	10.00	PF	3.4
2	17.6	5.6	24.1	27.5	11.5	120	FTG	T	PE	0.0
3	17.6	5.6	27.5	29.4		0.211	TL	16.00	PV	
Pipe: 3					-82.8	1.380	PL	10.00	PF	4.7
3	17.6	5.6	27.5	29.4	17.8	120	FTG	----	PE	0.0
4	17.6	5.6	32.2	31.8		0.474	TL	10.00	PV	
Pipe: 4					-114.6	1.380	PL	1.00	PF	0.9
4	17.6	5.6	32.2	31.8	24.6	120	FTG	----	PE	0.3
5	17.0	0.0	33.3	0.0		0.865	TL	1.00	PV	
Pipe: 5					-114.6	2.067	PL	13.00	PF	1.6
5	17.0	0.0	33.3	0.0	11.0	120	FTG	----	PE	0.0
10	17.0	0.0	34.9	0.0		0.121	TL	13.00	PV	
Pipe: 6					-26.6	1.049	PL	10.00	PF	2.7
6	17.6	5.6	22.6	26.6	9.9	120	FTG	E	PE	0.0
7	17.6	5.6	25.3	28.1		0.221	TL	12.00	PV	
Pipe: 7					-54.8	1.380	PL	10.00	PF	3.5
7	17.6	5.6	25.3	28.1	11.7	120	FTG	T	PE	0.0
8	17.6	5.6	28.8	30.0		0.221	TL	16.00	PV	
Pipe: 8					-84.8	1.380	PL	10.00	PF	5.0
8	17.6	5.6	28.8	30.0	18.2	120	FTG	----	PE	0.0
9	17.6	5.6	33.7	32.5		0.496	TL	10.00	PV	
Pipe: 9					-117.4	1.380	PL	1.00	PF	0.9
9	17.6	5.6	33.7	32.5	25.2	120	FTG	----	PE	0.3
10	17.0	0.0	34.9	0.0		0.904	TL	1.00	PV	
Pipe: 10					-232.0	2.067	PL	13.00	PF	5.8
10	17.0	0.0	34.9	0.0	22.2	120	FTG	----	PE	0.0
12	17.0	0.0	40.7	0.0		0.446	TL	13.00	PV	
Pipe: 11					-32.8	1.049	PL	10.00	PF	3.9
11	17.6	5.6	34.2	32.8	12.2	120	FTG	E	PE	0.3
11A	17.0	0.0	38.4	0.0		0.324	TL	12.00	PV	
Pipe: 12					-32.8	1.380	PL	21.00	PF	2.3
11A	17.0	0.0	38.4	0.0	7.0	120	FTG	T	PE	0.0
12	17.0	0.0	40.7	0.0		0.085	TL	27.00	PV	

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JOB TITLE:

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 19					-264.8	6.357	PL	150.00	PF 0.4
12	17.0	0.0	40.7	0.0	2.7	120	FTG	----	PE 0.0
13	17.0	0.0	41.1	0.0		0.002	TL	150.00	PV
Pipe: 20					-264.8	6.357	PL	50.00	PF 0.1
13	17.0	0.0	41.1	0.0	2.7	120	FTG	----	PE 0.0
14	17.0	0.0	41.2	0.0		0.002	TL	50.00	PV
Pipe: 21					-264.8	6.357	PL	10.00	PF 0.0
14	17.0	0.0	41.2	0.0	2.7	120	FTG	G	PE 3.9
TOR	8.0	0.0	45.1	0.0		0.002	TL	14.00	PV
Pipe: 22					-264.8	6.357	PL	8.00	PF 0.1
TOR	8.0	0.0	45.1	0.0	2.7	120	FTG	EB	PE 2.6
BOR	2.0	0.0	47.8	0.0		0.002	TL	39.00	PV
Pipe: 23					264.8	8.249	PL	50.00	PF 0.1
PO	2.0	0.0	47.9	0.0	1.6	120	FTG	C	PE 0.0
BOR	2.0	0.0	47.8	0.0		0.001	TL	103.00	PV
Pipe: 24			FIRE PUMP		Rating: 1000.0 gpm @ 100.0 psi				
PI	2.0	0.0	15.6	0.0	Avail.: 264.7 gpm @ 101.5 psi				
PO	2.0	0.0	47.9	0.0	Req'd.: 264.7 gpm @ 32.3 psi				
User Defined Pump Curve:			gpm	psi	gpm	psi			
			0.0	102.0	1250.0	85.0			
			500.0	101.0	1500.0	65.0			
			1000.0	100.0					
Pipe: 25					-264.8	8.249	PL	7.00	PF 0.0
PI	2.0	0.0	15.6	0.0	1.6	120	FTG	G	PE 3.0
15	-5.0	0.0	18.6	0.0		0.001	TL	12.00	PV
Pipe: 26					-264.8	8.249	PL	50.00	PF 0.0
15	-5.0	0.0	18.6	0.0	1.6	120	FTG	----	PE -3.9
HS	4.0	H.S.	14.8	250.0		0.001	TL	50.00	PV
Pipe: 27					-514.8	8.249	PL	12.00	PF 0.0
HS	4.0	H.S.	14.8	250.0	3.1	120	FTG	----	PE 5.2
SOURCE	-8.0	SRCE	20.0	(N/A)		0.002	TL	12.00	PV

NOTES (HASS):

(1) Calculations were performed by the HASS 8.5 computer program
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Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average imbalance at each node of 0.009 gpm and a maximum imbalance at any node of 0.092 gpm.

(3) Total pressure at each node is used in balancing the system. Maximum water velocity is 25.2 ft/sec at pipe 9.

(4) The Minimum pump suction pressure under maximum calculated demand is 15.60 (psi)

(5) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(6) Available pressure at source node SOURCE under full flow conditions is 55.24 psi compared to the minimum required pressure of 20.00 psi.

(7) PIPE FITTINGS TABLE

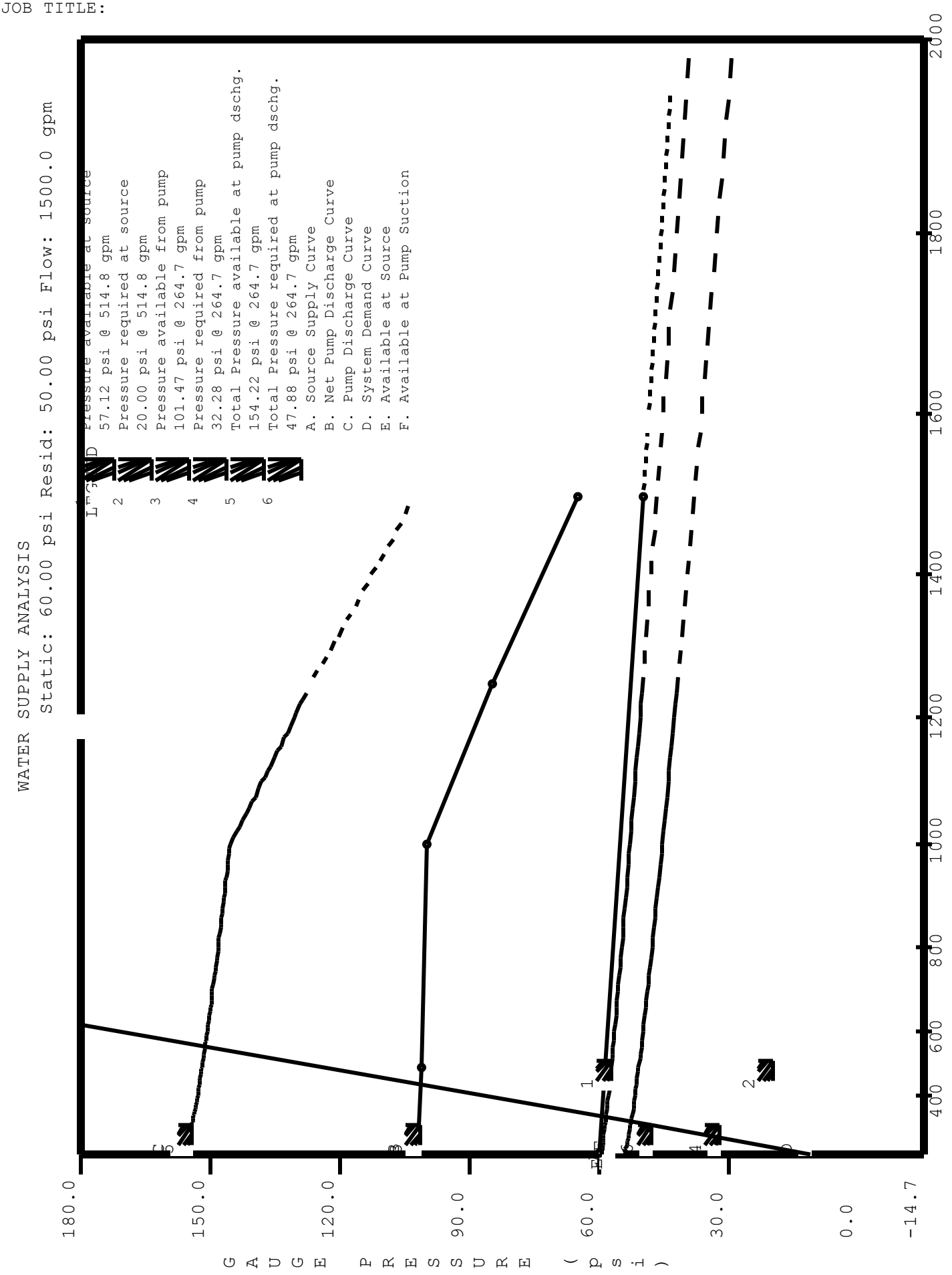
Pipe Table Name: STANDARD.PIP

PAGE: A MATERIAL: S40 HWC: 120

Diameter	Equivalent Fitting Lengths in Feet								
(in)	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
1.049	2.00	5.00	2.00	5.00	6.00	1.00	10.00	2.00	5.00
1.380	3.00	6.00	2.00	7.00	6.00	1.00	10.00	10.00	6.00
2.067	5.00	10.00	3.00	11.00	6.00	1.00	10.00	10.00	10.00

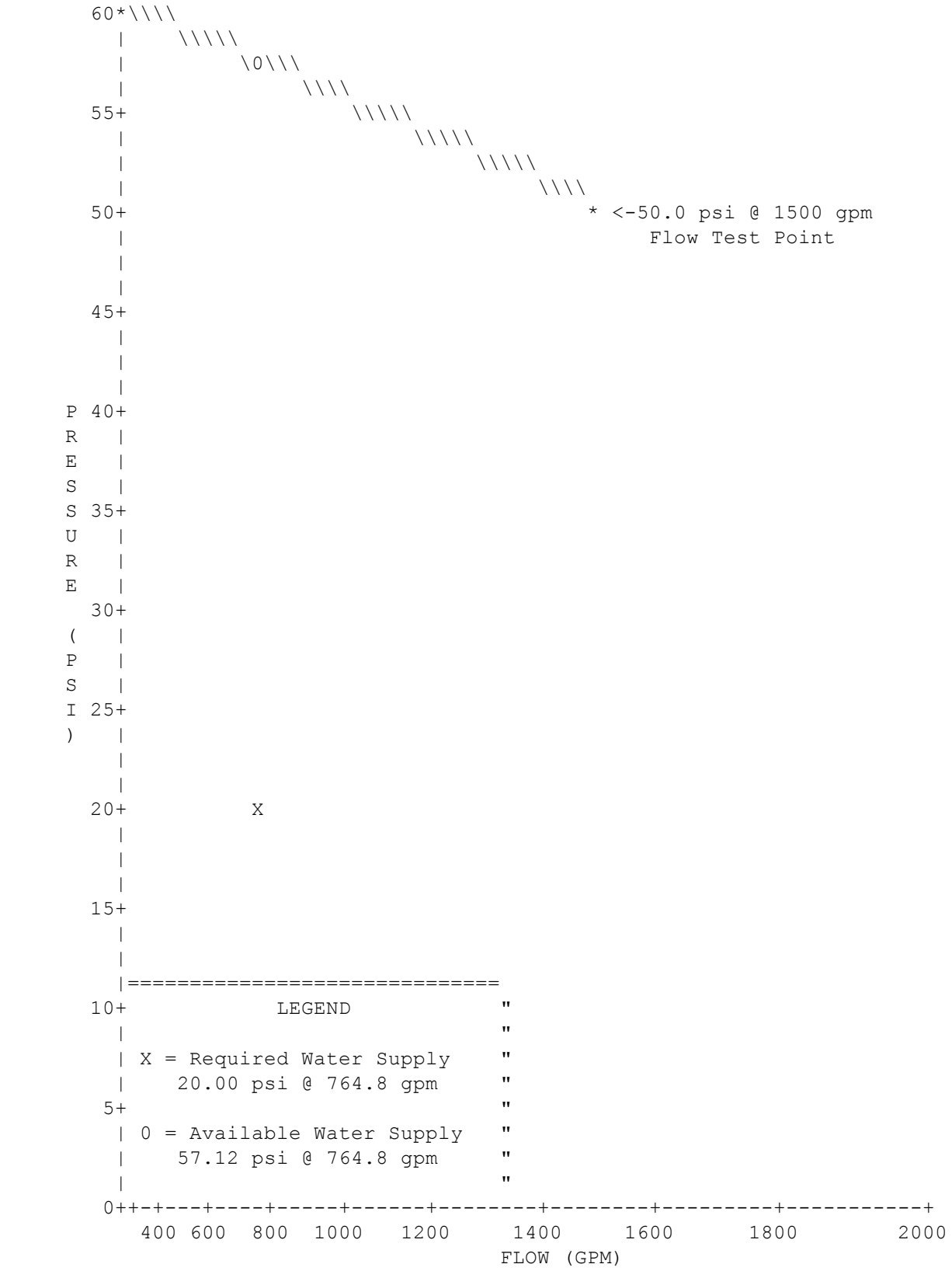
PAGE: B MATERIAL: THNWL HWC: 120

Diameter	Equivalent Fitting Lengths in Feet								
(in)	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
6.357	18.00	38.00	11.00	40.00	13.00	4.00	35.00	35.00	38.00
8.249	21.00	41.00	15.00	53.00	14.00	5.00	37.00	37.00	41.00


WATER SUPPLY ANALYSIS
Static: 60.00 psi Resid: 50.00 psi Flow: 1500.0 gpm
LEGEND
1 Pressure available at source
57.12 psi @ 514.8 gpm
2 Pressure required at source
20.00 psi @ 514.8 gpm
3 Pressure available from pump
101.47 psi @ 264.7 gpm
4 Pressure required from pump
32.28 psi @ 264.7 gpm
5 Total Pressure available at pump dschg.
154.22 psi @ 264.7 gpm
6 Total Pressure required at pump dschg.
47.88 psi @ 264.7 gpm
A. Source Supply Curve
B. Net Pump Discharge Curve
C. Pump Discharge Curve
D. System Demand Curve
E. Available at Source
F. Available at Pump Suction
GAUGE PRESSURE (psi)
180.0
150.0
120.0
90.0
60.0
30.0
0.0
-14.7
400
600
800
1000
1200
1400
1600
1800
2000

DATE: 3/13/2016 E:\FPE 596 PROJECT\HYDRAULIC CALCS\CAFE.SDF
JOB TITLE:

WATER SUPPLY CURVE



DATE: 3/13/2016 E:\FPE 596 PROJECT\HYDRAULIC CALCS\NORTH TOWER.SDF
JOB TITLE: 13TH FLOOR - SOUTH

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	@ FLOW (GPM)	AVAIL. PRESS. (PSI)	@ TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	60.0	50.0	1200.0	58.1	492.7	20.0

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	492.7 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	242.7 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
1	124.0	K= 5.60	20.2	25.2
2	124.0	K= 5.60	21.0	25.6
3	124.0	K= 5.60	22.2	26.4
4	124.0	K= 5.60	22.8	26.7
5	124.0	K= 5.60	20.9	25.6
6	124.0	K= 5.60	21.7	26.1
7	124.0	K= 5.60	22.4	26.5
8	124.0	K= 5.60	27.1	29.2
9	124.0	K= 5.60	31.3	31.4
10	123.5	- - - -	22.6	- - -
11	123.5	- - - -	23.2	- - -
12	123.5	- - - -	24.4	- - -
13	123.5	- - - -	27.6	- - -
14	123.5	- - - -	31.9	- - -
15	123.5	- - - -	39.8	- - -
16	123.5	- - - -	39.9	- - -
16A	120.0	- - - -	42.1	- - -
17	120.0	- - - -	52.1	- - -
18	16.0	- - - -	97.4	- - -
19	2.0	- - - -	15.7	- - -
20	3.0	- - - -	103.3	- - -
TOR	12.0	- - - -	99.3	- - -
BOR	3.0	- - - -	103.3	- - -
PI	2.0	- - - -	15.5	- - -
PO	2.0	- - - -	103.8	- - -
SOURCE	-8.0	SOURCE	20.0	242.7

DATE: 3/13/2016 E:\FPE 596 PROJECT\HYDRAULIC CALCS\NORTH TOWER.SDF
JOB TITLE: 13TH FLOOR - SOUTH

PIPE DATA

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 1					-25.2	1.380 PL	10.50	PF	0.7
1	124.0	5.6	20.2	25.2	5.4	120 FTG	E	PE	0.0
2	124.0	5.6	21.0	25.6		0.052 TL	13.50	PV	
Pipe: 2					-50.8	1.610 PL	7.50	PF	1.4
2	124.0	5.6	21.0	25.6	8.0	120 FTG	T	PE	0.2
10	123.5	0.0	22.6	0.0		0.091 TL	15.50	PV	
Pipe: 3					-26.4	1.610 PL	1.00	PF	0.1
3	124.0	5.6	22.2	26.4	4.2	120 FTG	E	PE	0.2
10	123.5	0.0	22.6	0.0		0.027 TL	5.00	PV	
Pipe: 4					-26.7	1.610 PL	1.00	PF	0.2
4	124.0	5.6	22.8	26.7	4.2	120 FTG	T	PE	0.2
11	123.5	0.0	23.2	0.0		0.028 TL	9.00	PV	
Pipe: 5					-25.6	1.380 PL	10.50	PF	0.7
5	124.0	5.6	20.9	25.6	5.5	120 FTG	E	PE	0.0
6	124.0	5.6	21.7	26.1		0.054 TL	13.50	PV	
Pipe: 6					-51.7	1.610 PL	7.50	PF	0.7
6	124.0	5.6	21.7	26.1	8.1	120 FTG	----	PE	0.0
7	124.0	5.6	22.4	26.5		0.094 TL	7.50	PV	
Pipe: 7					-78.2	1.610 PL	1.00	PF	1.8
7	124.0	5.6	22.4	26.5	12.3	120 FTG	T	PE	0.2
12	123.5	0.0	24.4	0.0		0.201 TL	9.00	PV	
Pipe: 8					-29.2	1.610 PL	1.00	PF	0.3
8	124.0	5.6	27.1	29.2	4.6	120 FTG	T	PE	0.2
13	123.5	0.0	27.6	0.0		0.032 TL	9.00	PV	
Pipe: 9					-31.4	1.610 PL	1.00	PF	0.3
9	124.0	5.6	31.3	31.4	4.9	120 FTG	T	PE	0.2
14	123.5	0.0	31.9	0.0		0.037 TL	9.00	PV	
Pipe: 10					-77.2	2.157 PL	14.00	PF	0.7
10	123.5	0.0	22.6	0.0	6.8	120 FTG	----	PE	0.0
11	123.5	0.0	23.2	0.0		0.047 TL	14.00	PV	
Pipe: 11					-104.0	2.157 PL	14.00	PF	1.1
11	123.5	0.0	23.2	0.0	9.1	120 FTG	----	PE	0.0
12	123.5	0.0	24.4	0.0		0.082 TL	14.00	PV	
Pipe: 12					-182.1	2.157 PL	14.00	PF	3.2
12	123.5	0.0	24.4	0.0	16.0	120 FTG	----	PE	0.0
13	123.5	0.0	27.6	0.0		0.231 TL	14.00	PV	

DATE: 3/13/2016 E:\FPE 596 PROJECT\HYDRAULIC CALCS\NORTH TOWER.SDF
JOB TITLE: 13TH FLOOR - SOUTH

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 19					-211.3	2.157 PL	14.00	PF	4.3
13	123.5	0.0	27.6	0.0	18.6	120 FTG	----	PE	0.0
14	123.5	0.0	31.9	0.0		0.305 TL	14.00	PV	
Pipe: 20					-242.7	3.260 PL	150.00	PF	7.9
14	123.5	0.0	31.9	0.0	9.3	120 FTG	----	PE	0.0
15	123.5	0.0	39.8	0.0		0.053 TL	150.00	PV	
Pipe: 21					-242.7	4.260 PL	10.00	PF	0.1
15	123.5	0.0	39.8	0.0	5.5	120 FTG	----	PE	0.0
16	123.5	0.0	39.9	0.0		0.014 TL	10.00	PV	
Pipe: 22					-242.7	4.260 PL	5.00	PF	0.7
16	123.5	0.0	39.9	0.0	5.5	120 FTG	2EB	PE	1.5
16A	120.0	0.0	42.1	0.0		0.014 TL	47.00	PV	
Pipe: 22A					FIXED PRESSURE LOSS DEVICE				
17	120.0	0.0	52.1	0.0	10.0 psi, 242.7 gpm				
16A	120.0	0.0	42.1	0.0					
Pipe: 23					-242.7	6.357 PL	110.00	PF	0.3
17	120.0	0.0	52.1	0.0	2.5	120 FTG	E	PE	45.1
18	16.0	0.0	97.4	0.0		0.002 TL	128.00	PV	
Pipe: 24					-242.7	6.357 PL	10.00	PF	0.1
18	16.0	0.0	97.4	0.0	2.5	120 FTG	2E	PE	1.7
TOR	12.0	0.0	99.3	0.0		0.002 TL	46.00	PV	
Pipe: 25					-242.7	6.357 PL	9.00	PF	0.1
TOR	12.0	0.0	99.3	0.0	2.5	120 FTG	EB	PE	3.9
BOR	3.0	0.0	103.3	0.0		0.002 TL	40.00	PV	
Pipe: 26					-242.7	6.357 PL	10.00	PF	0.1
BOR	3.0	0.0	103.3	0.0	2.5	120 FTG	E	PE	0.0
20	3.0	0.0	103.3	0.0		0.002 TL	28.00	PV	
Pipe: 26A					242.7	6.357 PL	10.00	PF	0.1
PO	2.0	0.0	103.8	0.0	2.5	120 FTG	C	PE	-0.4
20	3.0	0.0	103.3	0.0		0.002 TL	50.00	PV	
Pipe: 27			FIRE PUMP		Rating: 1000.0 gpm @ 100.0 psi				
PI	2.0	0.0	15.5	0.0	Avail.: 242.7 gpm @ 101.5 psi				
PO	2.0	0.0	103.8	0.0	Req'd.: 242.7 gpm @ 88.3 psi				
User Defined Pump Curve:			gpm	psi	gpm	psi			
			0.0	102.0	1250.0	85.0			
			500.0	101.0	1500.0	65.0			
			1000.0	100.0					
Pipe: 28					-242.7	6.357 PL	50.00	PF	0.1
PI	2.0	0.0	15.5	0.0	2.5	120 FTG	G	PE	0.0
19	2.0	0.0	15.7	0.0		0.002 TL	54.00	PV	

DATE: 3/13/2016 E:\FPE 596 PROJECT\HYDRAULIC CALCS\NORTH TOWER.SDF
JOB TITLE: 13TH FLOOR - SOUTH

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	Q(GPM) DISC. (GPM)	VEL(FPS) HW(C) FL/FT	DIA(IN) LENGTH (FT)		PRESS. SUM. (PSI)	
Pipe: 30				-242.7	8.249	PL	20.00	PF	0.0
19	2.0	0.0	15.7	0.0	1.5	120	FTG ----	PE	4.3
SOURCE	-8.0	SRCE	20.0	(N/A)		0.001	TL 20.00	PV	

NOTES (HASS):

(1) Calculations were performed by the HASS 8.5 computer program
under license no. 38061308 granted by
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average
imbalance at each node of 0.004 gpm and a maximum
imbalance at any node of 0.050 gpm.

(3) Total pressure at each node is used in balancing the system.
Maximum water velocity is 18.6 ft/sec at pipe 19.

(4) The Minimum pump suction pressure under maximum
calculated demand is 15.55 (psi)

(5) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(6) Available pressure at source node SOURCE under full flow conditions is
57.09 psi compared to the minimum required pressure of 20.00 psi.

(7) PIPE FITTINGS TABLE

Pipe Table Name: STANDARD.PIP

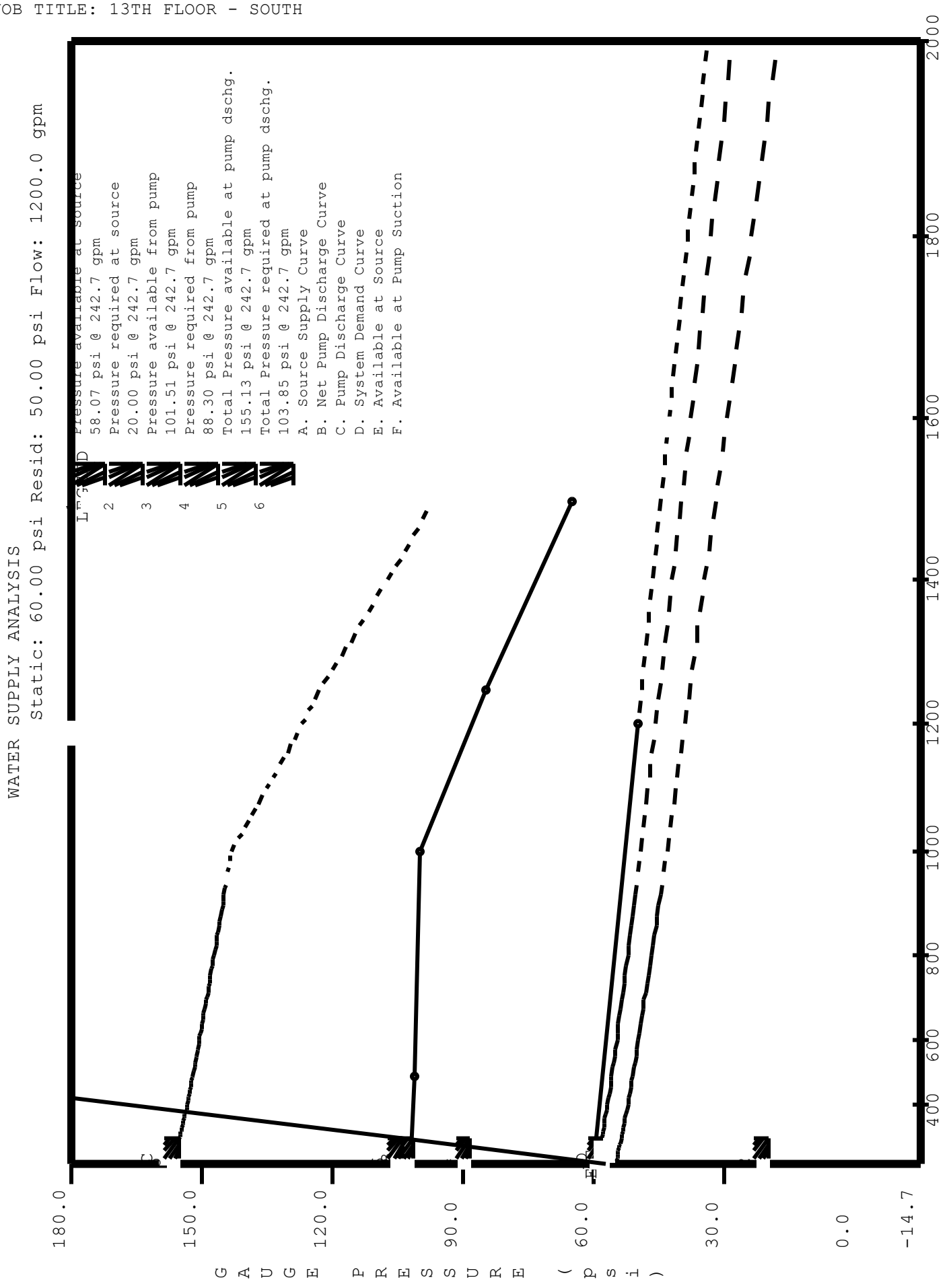
PAGE: A MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
1.380	3.00	6.00	2.00	7.00	6.00	1.00	10.00	10.00	6.00
1.610	4.00	8.00	2.00	9.00	6.00	1.00	10.00	10.00	8.00

PAGE: B MATERIAL: THNWL HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
2.157	6.00	12.00	3.00	14.00	8.00	1.00	12.00	12.00	12.00
3.260	10.00	20.00	7.00	22.00	14.00	1.00	18.00	18.00	20.00
4.260	13.00	26.00	8.00	29.00	16.00	3.00	26.00	26.00	26.00
6.357	18.00	38.00	11.00	40.00	13.00	4.00	35.00	35.00	38.00
8.249	21.00	41.00	15.00	53.00	14.00	5.00	37.00	37.00	41.00

DATE: 3/13/2016 E:\FPE 596 PROJECT\HYDRAULIC CALCS\NORTH TOWER.SDF
JOB TITLE: 13TH FLOOR - SOUTH



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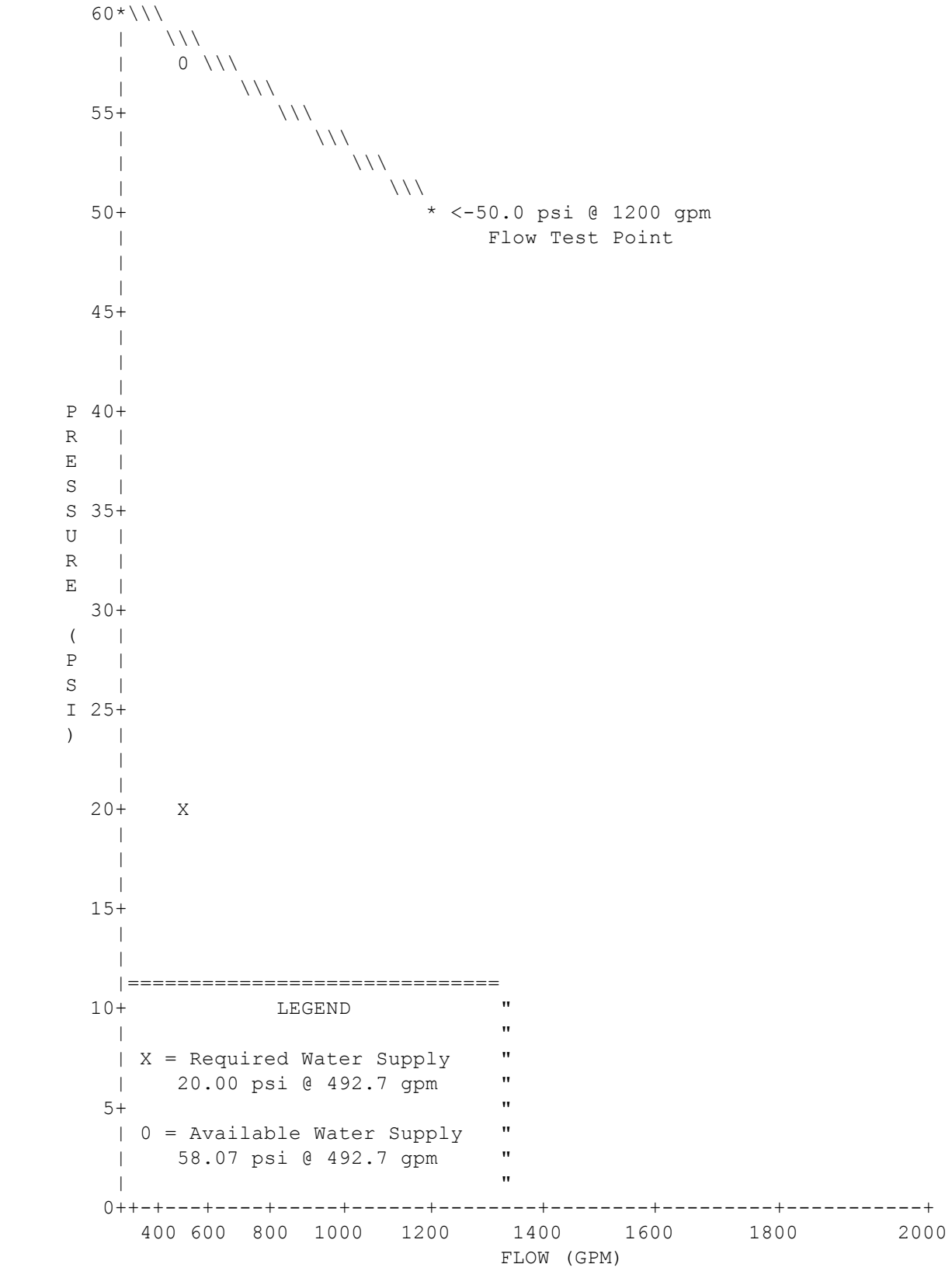
JOB TITLE: 13TH FLOOR - SOUTH

WATER SUPPLY CURVE



APPENDIX I
FIRE SPRINKLER PRODUCT DATA SHEETS

Series TY-FRB — ~~2.8, 4.2~~, 5.6, and 8.0 K-Factor Upright, Pendent, and Recessed Pendent Sprinklers Quick Response, Standard Coverage

General Description

The TYCO Series TY-FRB, 2.8, 4.2, 5.6, and 8.0 K-factor, Upright, Pendent, and Recessed Pendent Sprinklers described in this data sheet are quick response, standard coverage, decorative 3 mm glass bulb-type spray sprinklers designed for use in light or ordinary hazard, commercial occupancies such as banks, hotels, and shopping malls.

The recessed version of the Series TY-FRB Pendent Sprinkler, where applicable, is intended for use in areas with a finished ceiling. This recessed pendent sprinkler uses one of the following:

- A two-piece Style 10 (1/2 inch NPT) or Style 40 (3/4 inch NPT) Recessed Escutcheon with 1/2 inch (12,7 mm) of recessed adjustment or up to 3/4 inch (19,1 mm) of total adjustment from the flush pendent position, or a
- A two-piece Style 20 (1/2 inch NPT) or Style 30 (3/4 inch NPT) Recessed Escutcheon with 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush pendent position.

The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the fixed pipe drops to the sprinklers must be cut.

Corrosion-resistant coatings, where applicable, are utilized to extend the life of copper alloy sprinklers beyond that which would otherwise be obtained when exposed to corrosive atmospheres. Although corrosion-resistant coated sprinklers have passed the standard corrosion tests of the applicable approval agencies, the testing is not representative of all possible corrosive atmospheres. Consequently, it is recommended that the end user be consulted with respect to the suitability of these coatings for any given corrosive environment. The effects of ambient temperature, concentration of chemicals, and gas/chemical velocity, should be considered, as a minimum, along with the corrosive nature of the chemical to which the sprinklers will be exposed.

An intermediate level of the Series TY-FRB Pendent Sprinklers is detailed in Technical Data Sheet TFP356, and Sprinkler Guards are detailed in Technical Data Sheet TFP780.

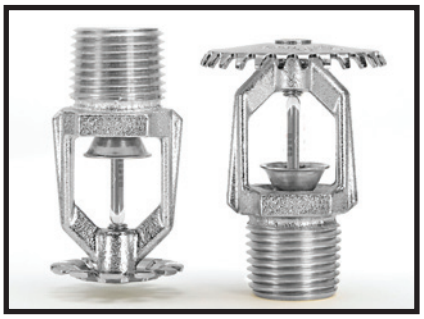
IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

NOTICE

The Series TY-FRB Concealed Pendent Sprinklers described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.



Sprinkler Identification Number (SIN)

TY1131:	Upright	2.8K, 1/2″ NPT
TY1231:	Pendent	2.8K, 1/2″ NPT
TY2131:	Upright	4.2K, 1/2″ NPT
TY2231:	Pendent	4.2K, 1/2″ NPT
TY3131:	Upright	5.6K, 1/2″ NPT
TY3231:	Pendent	5.6K, 1/2″ NPT
TY4131:	Upright	8.0K, 3/4″ NPT
TY4231:	Pendent	8.0K, 3/4″ NPT
TY4831:	Upright*	8.0K, 1/2″ NPT
TY4931:	Pendent*	8.0K, 1/2″ NPT

*Eastern Hemisphere Sales Only

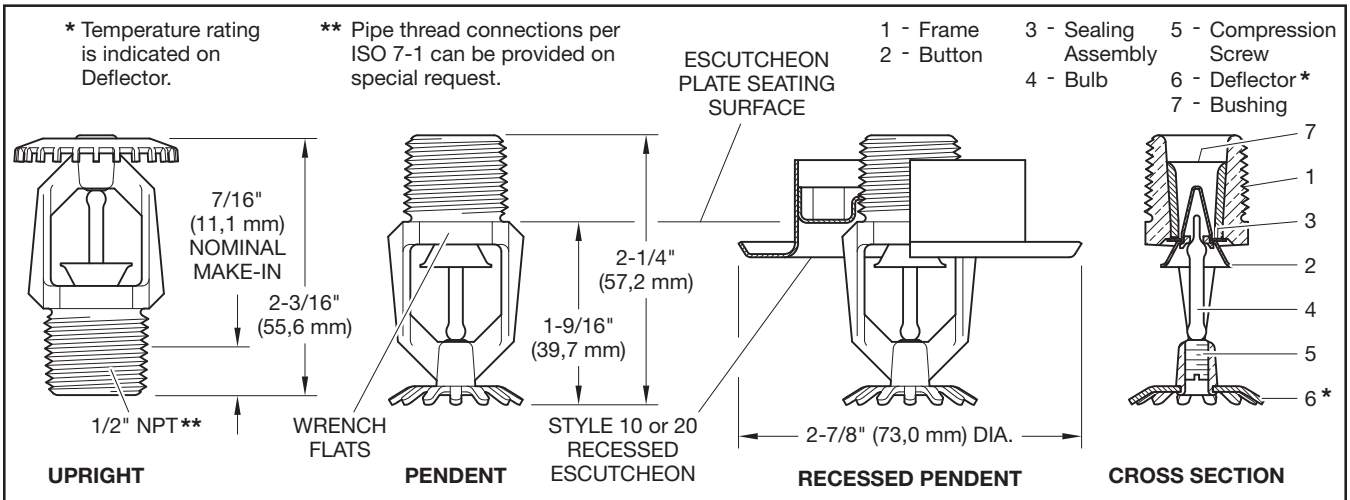


FIGURE 1
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY1131) AND PENDENT (TY1231) SPRINKLERS
2.8 K-FACTOR, 1/2 INCH NPT

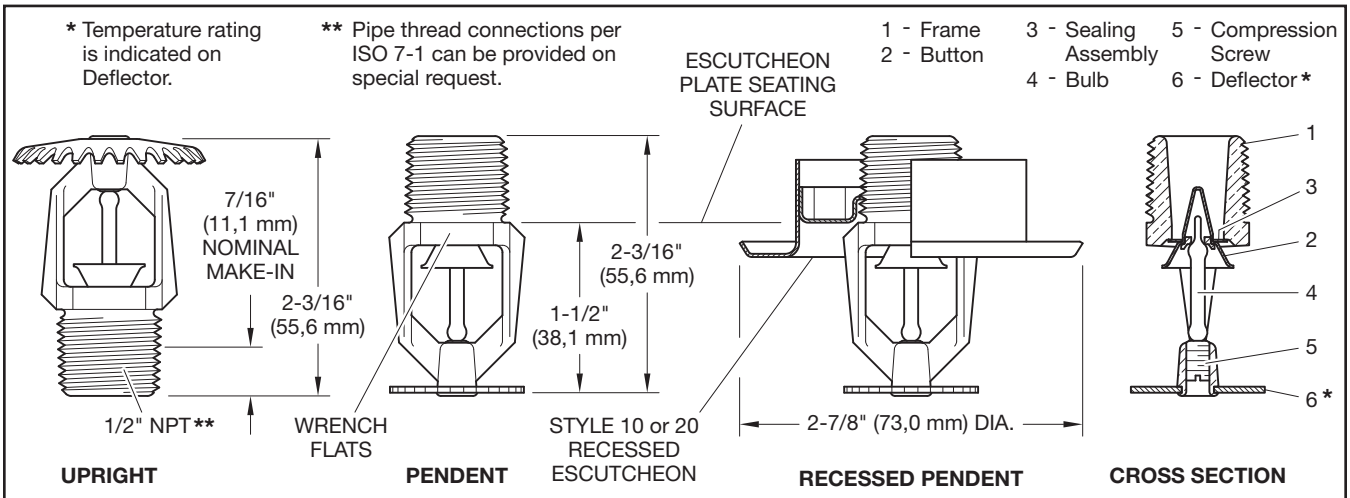


FIGURE 2
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY2131) AND PENDENT (TY2231) SPRINKLERS
4.2 K-FACTOR, 1/2 INCH NPT

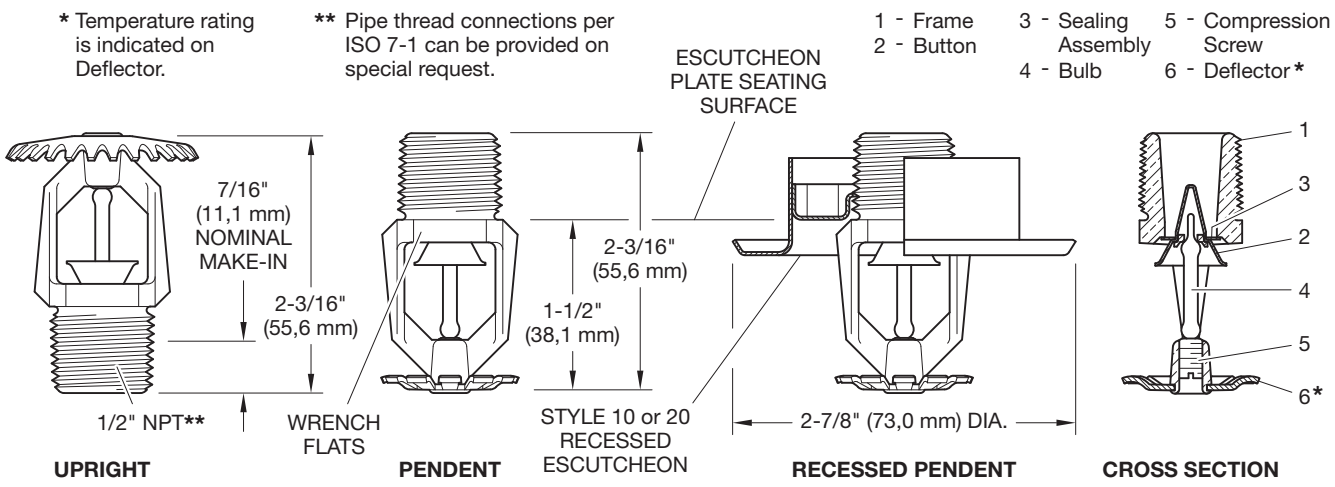


FIGURE 3
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY3131) AND PENDENT (TY3231) SPRINKLERS
5.6 K-FACTOR, 1/2 INCH NPT

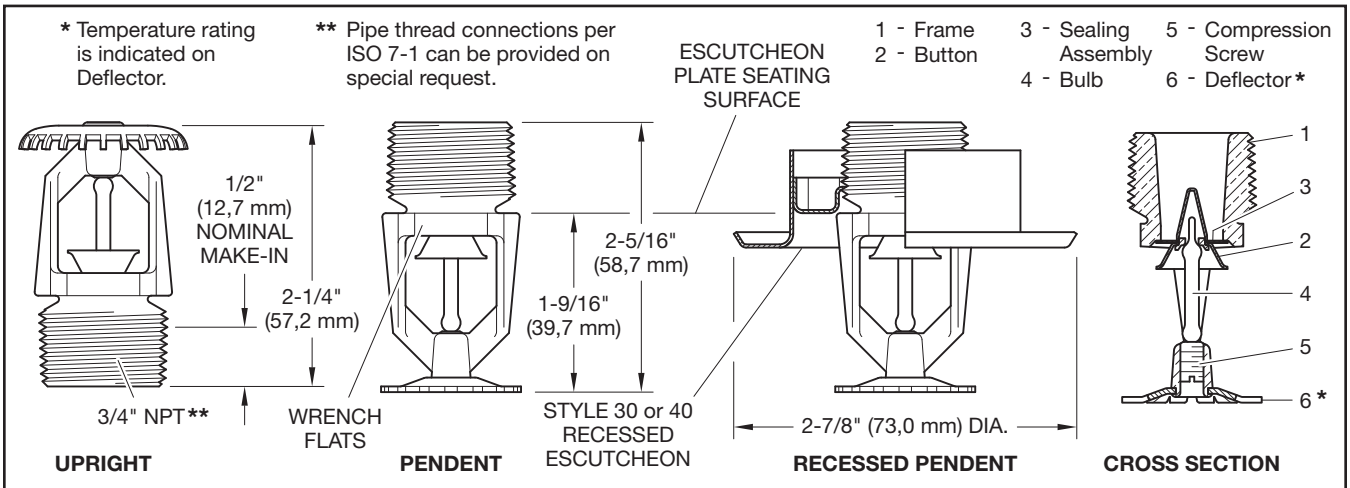
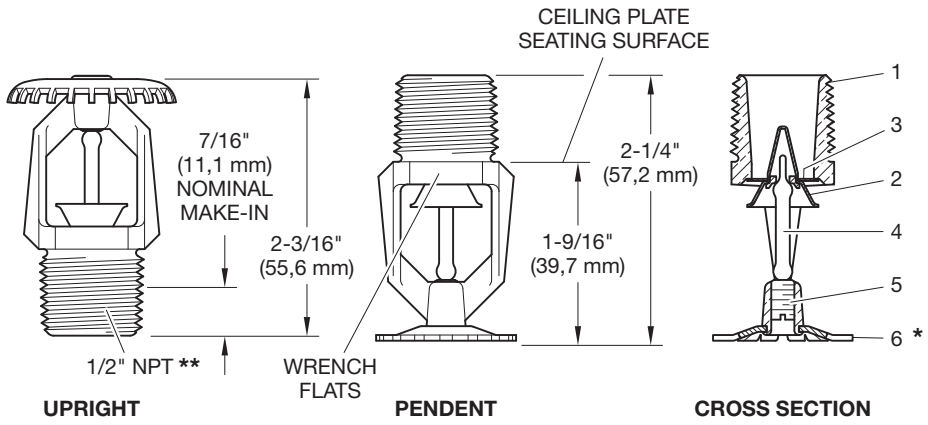


FIGURE 4
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY4131) AND PENDENT (TY4231) SPRINKLERS
8.0 K-FACTOR, 3/4 INCH NPT



1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector *

* Temperature rating is indicated on Deflector.

** Pipe thread connections per ISO 7-1 can be provided on special request.

FIGURE 5
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY4831) AND PENDENT (TY4931) SPRINKLERS
8.0 K-FACTOR, 1/2 INCH NPT

Technical Data

Approvals
UL and C-UL Listed
FM, LPCB, and NYC Approved
Refer to Table A and B for complete approval information including corrosion-resistant status.

Maximum Working Pressure
Refer to Table C.

Discharge Coefficient

K=2.8 GPM/psi$^{1/2}$	(40,3 LPM/bar$^{1/2}$)
K=4.2 GPM/psi$^{1/2}$	(60,5 LPM/bar$^{1/2}$)
K=5.6 GPM/psi$^{1/2}$	(80,6 LPM/bar$^{1/2}$)
K=8.0 GPM/psi$^{1/2}$	(115,2 LPM/bar$^{1/2}$)

Temperature Rating
Refer to Table A and B.

Finishes
Sprinkler: Refer to Table A and B.
Recessed Escutcheon: White Coated, Chrome Plated, or Brass Plated.

Physical Characteristics

Frame	Bronze
Button	Brass/Copper
Sealing Assembly	Beryllium Nickel w/TEFLON
Bulb	Glass
Compression Screw	Bronze
Deflector	Copper/Bronze
Bushing (K=2.8)	Bronze

Operation

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, allowing the sprinkler to activate and water to flow.

Design Criteria

The TYCO Series TY-FRB, 2.8, 4.2, 5.6, and 8.0 K-factor, Upright, Pendent, and Recessed Pendent Sprinklers are intended for fire protection systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency (such as, UL Listing is based on the requirements of NFPA 13, and FM Approval is based on the requirements of FM's Loss Prevention Data Sheets). Only the Style 10, 20, 30, or 40 Recessed Escutcheon, as applicable, is to be used for recessed pendent installations.

Installation

The TYCO Series TY-FRB, 2.8, 4.2, 5.6, and 8.0 K-factor, Upright, Pendent, and Recessed Pendent Sprinklersmust be installed in accordance with this section.

General Instructions
Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm) for the 135°F (57°C) and 3/32 inch (2,4 mm) for the 286°F (141°C) temperature ratings.

A leak-tight 1/2 inch NPT sprinkler joint shold be obtained by applying a minimum to maximum torque of 7 to 14 ft.l-bs. (9,5 to 19,0 Nm). Higher levels of torque can distort the sprinkler Inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Escutcheon Plate by under- or over-tightening the sprinkler. Re-adjust the position of the sprinkler fitting to suit.

Series TY-FRB Upright and Pendent Sprinklers
The Series TY-FRB Pendent and Upright Sprinklers must be installed in accordance with the following instructions.

Step 1. Install Pendent sprinklers in the pendent position. Install upright sprinklers in the upright position.

Step 2. With pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Figure 14). With reference to Figures 1 through 5, apply the W-Type 6 Sprinkler Wrench to the sprinkler wrench flats.

Series TY-FRB Recessed Pendent Sprinklers
The Series TY-FRB Recessed Pendent Sprinklers must be installed in accordance with the following instructions.

Step A. After installing the Style 10, 20, 30, or 40 Mounting Plate, as applicable, over the sprinkler threads and with pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step B. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Figure 15). With reference to Figures 1 to 4, apply the W-Type 7 Recessed Sprinkler Wrench to the sprinkler wrench flats.

Step C. After ceiling installation and finishing, slide on the Style 10, 20, 30, or 40 Closure over the Series TY-FRB Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling.

K FACTOR	TYPE	TEMPERATURE	SPRINKLER FINISH (See Note 5)			
			BULB LIQUID COLOR	NATURAL BRASS	CHROME PLATED	SIGNAL*** WHITE
2.8 1/2" NPT	PENDENT (TY1231) and UPRIGHT (TY1131)	135°F (57°C)	Orange	1, 2, 3, 4		
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			
		286°F (141°C)	Blue			
	RECESSED PENDENT (TY1231)* Figure 6	135°F (57°C)	Orange	1, 2, 4		
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			
	RECESSED PENDENT (TY1231)** Figure 7	135°F (57°C)	Orange			
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			
4.2 1/2" NPT	PENDENT (TY2231) and UPRIGHT (TY2131)	135°F (57°C)	Orange	1, 2		
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			
		286°F (141°C)	Blue			
	RECESSED PENDENT (TY2231)* Figure 8	135°F (57°C)	Orange			
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			
	RECESSED PENDENT (TY2231)** Figure 9	135°F (57°C)	Orange			
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			

NOTES:

1. Listed by Underwriters Laboratories, Inc., (UL) as Quick Response Sprinklers.
2. Listed by Underwriters Laboratories, Inc., for use in Canada (C-UL) as Quick Response Sprinklers.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers.
4. Approved by the City of New York under MEA 354-01-E.
5. Where Polyester Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion-Resistant Sprinklers.

* Installed with Style 10 (1/2" NPT) or Style 40 (3/4" NPT) 3/4" Total Adjustment Recessed Escutcheon, as applicable.

** Installed with Style 20 (1/2" NPT) or Style 30 (3/4" NPT) 1/2" Total Adjustment Recessed Escutcheon, as applicable.

*** Frame and Deflector only. Listings and approvals apply to color (Special Order).

N/A: Not Available

TABLE A
LABORATORY LISTINGS AND APPROVALS FOR
2.8 AND 4.2 K-FACTOR SPRINKLERS

K FACTOR	TYPE	TEMPERATURE	SPRINKLER FINISH (See Note 8)				
			BULB LIQUID COLOR	NATURAL BRASS	CHROME PLATED	SIGNAL*** WHITE	LEAD COATED
5.6 1/2" NPT	PENDENT (TY3231) and UPRIGHT (TY3131)	135°F (57°C)	Orange	1, 2, 3, 4, 5, 6, 7			1, 2, 3, 5
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
	RECESSED PENDENT (TY3231)* Figure 10	135°F (57°C)	Orange	1, 2, 4, 5			N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
	RECESSED PENDENT (TY3231)** Figure 11	135°F (57°C)	Orange	1, 2, 3, 4, 5			N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
8.0 3/4" NPT	PENDENT (TY4231) and UPRIGHT (TY4131)	135°F (57°C)	Orange	1, 2, 3, 4, 5, 6, 7			1, 2, 5
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
	RECESSED PENDENT (TY4231)* Figure 12	135°F (57°C)	Orange	1, 2, 5			N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
	RECESSED PENDENT (TY4231)** Figure 13	135°F (57°C)	Orange	1, 2, 3, 5			N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
8.0 1/2" NPT	PENDENT (TY4931) and UPRIGHT (TY4831)	135°F (57°C)	Orange	1, 2, 4, 5, 6			1, 2, 5
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				

NOTES:

1. Listed by Underwriters Laboratories, Inc., (UL) as Quick Response Sprinklers.
2. Listed by Underwriters Laboratories, Inc., for use in Canada (C-UL) as Quick Response Sprinklers.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers.
4. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 007k/04) as Quick Response Sprinklers. However, LPCB does not rate the thermal sensitivity of recessed sprinklers.
5. Approved by the City of New York under MEA 354-01-E.
6. VdS Approved (For details, contact Tyco Fire Suppression & Building Products, Enschede, Netherlands, Tel. 31-53-428-4444/Fax 31-53-428-3377.)
7. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06) as Quick Response Sprinklers.
8. Where Polyester Coated and Lead-Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion-Resistant Sprinklers. Where Lead-Coated Sprinklers are noted to be FM Approved, the sprinklers are FM Approved as a Corrosion-Resistant Sprinklers.

* Installed with Style 10 (1/2" NPT) or Style 40 (3/4" NPT) 3/4" Total Adjustment Recessed Escutcheon, as applicable.
** Installed with Style 20 (1/2" NPT) or Style 30 (3/4" NPT) 1/2" Total Adjustment Recessed Escutcheon, as applicable.
*** Frame and Deflector only. Listings and approvals apply to color (Special Order).
N/A: Not Available

TABLE B
LABORATORY LISTINGS AND APPROVALS FOR
5.6 AND 8.0 K-FACTOR SPRINKLERS

K FACTOR	TYPE	SPRINKLER FINISH			
		NATURAL BRASS	CHROME PLATED	SIGNAL WHITE	LEAD COATED
2.8 1/2" NPT	PENDENT (TY1231) and UPRIGHT (TY1131)	175 PSI (12,1 BAR)			N/A
	RECESSED PENDENT (TY1231)				
4.2 1/2" NPT	PENDENT (TY2231) and UPRIGHT (TY2131)	175 PSI (12,1 BAR)			N/A
	RECESSED PENDENT (TY2231)				
5.6 1/2" NPT	PENDENT (TY3231) and UPRIGHT (TY3131)	250 PSI (17,2 BAR) OR 175 PSI (12,1 BAR) (SEE NOTE 1)			175 PSI (12,1 BAR)
	RECESSED PENDENT (TY3231)				N/A
8.0 3/4" NPT	PENDENT (TY4231) and UPRIGHT (TY4131)	175 PSI (12,1 BAR)			175 PSI (12,1 BAR)
	RECESSED PENDENT (TY4231)				N/A
8.0 1/2" NPT	PENDENT (TY4931) and UPRIGHT (TY4831)	175 PSI (12,1 BAR)			175 PSI (12,1 BAR)

NOTES:
1. The maximum working pressure of 250 psi (17,2 bar) only applies to the Listing by Underwriters Laboratories Inc. (UL); the Listing by Underwriters Laboratories, Inc. for use in Canada (C-UL); and, the Approval by the City of New York.

TABLE C
MAXIMUM WORKING PRESSURE

Care and Maintenance

The TYCO Series TY-FRB must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection systems from the proper authorities and notify all personnel who may be affected by this action.

Absence of the outer piece of an escutcheon, which is used to cover a clearance hole, can delay sprinkler operation in a fire situation.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section.)

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Care must be exercised to avoid damage to the sprinklers -before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

Initial and frequent visual inspections of random samples are recommended for corrosion-resistant sprinklers to verify the integrity of the corrosion-resistant material of construction. Thereafter, annual inspections per NFPA 25 should suffice.

Inspections of corrosion-resistant sprinklers are recommended at close range, instead of from the floor level per NFPA. Inspection at close range can better determine the exact sprinkler condition and the long-term integrity of the corrosion-resistant material, which can be affected by the corrosive conditions present.

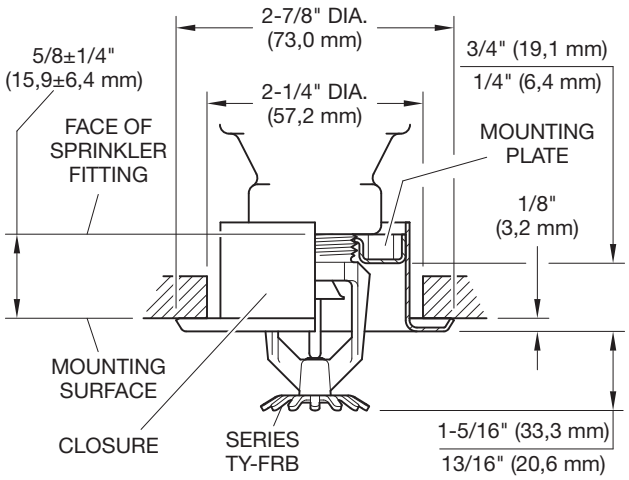


FIGURE 6
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 10 RECESSED ESCUTCHEON
2.8 K-FACTOR, 1/2 INCH NPT

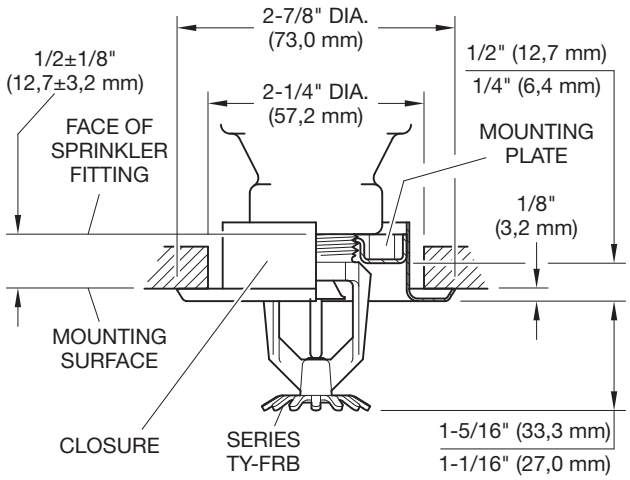


FIGURE 7
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 20 RECESSED ESCUTCHEON
2.8 K-FACTOR, 1/2 INCH NPT

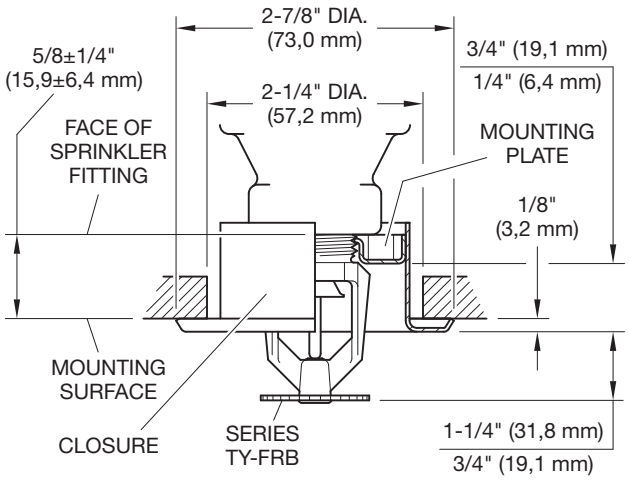


FIGURE 8
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 10 RECESSED ESCUTCHEON
4.2 K-FACTOR, 1/2 INCH NPT

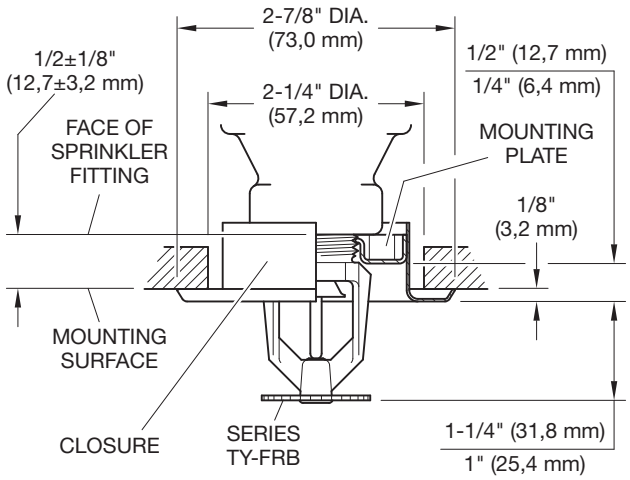


FIGURE 9
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 20 RECESSED ESCUTCHEON
4.2 K-FACTOR, 1/2 INCH NPT

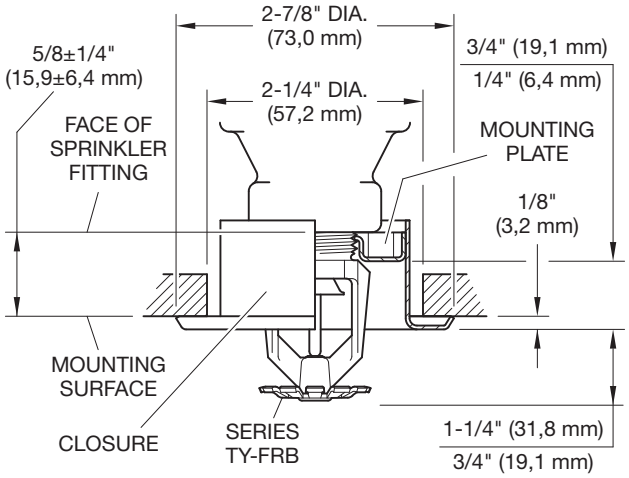


FIGURE 10
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 10 RECESSED ESCUTCHEON
5.6 K-FACTOR, 1/2 INCH NPT

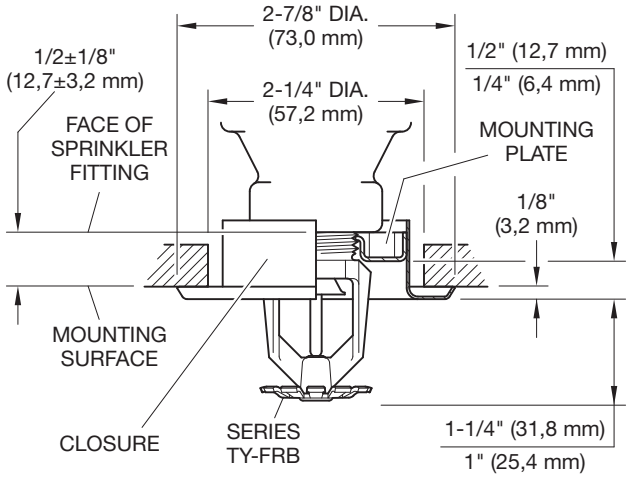


FIGURE 11
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 20 RECESSED ESCUTCHEON
5.6 K-FACTOR, 1/2 INCH NPT

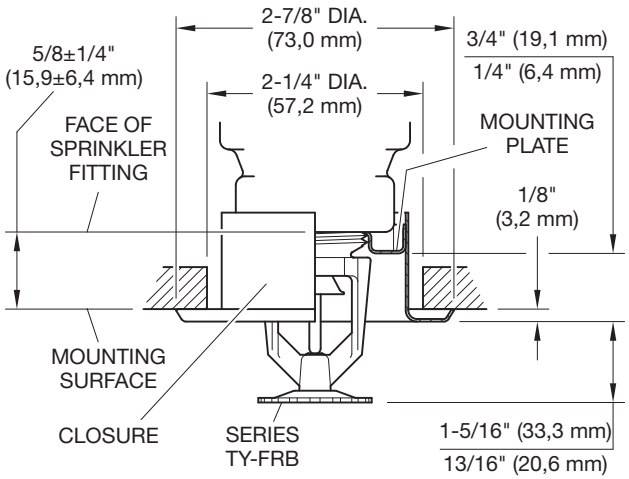


FIGURE 12
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 40 RECESSED ESCUTCHEON
8.0 K-FACTOR, 3/4 INCH NPT

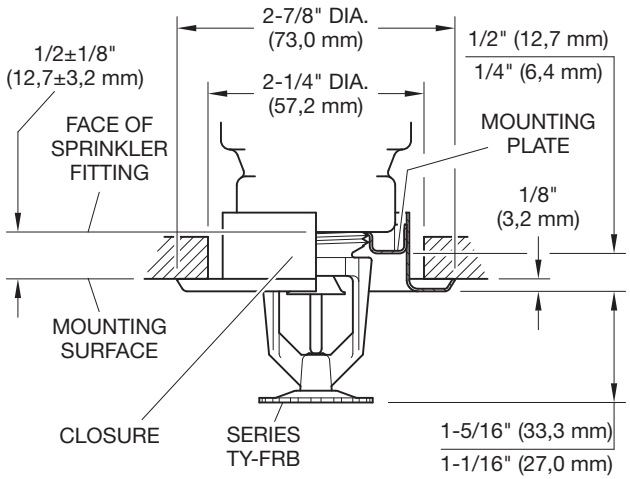


FIGURE 13
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 30 RECESSED ESCUTCHEON
8.0 K-FACTOR, 3/4 INCH NPT

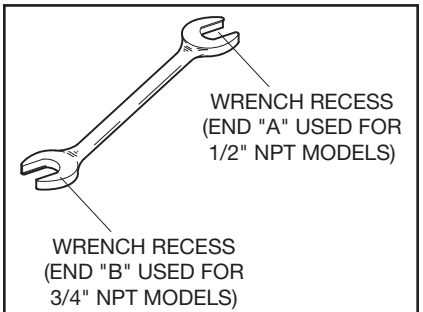


FIGURE 14
W-TYPE 6 SPRINKLER
WRENCH

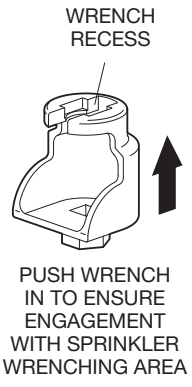


FIGURE 15
W-TYPE 7 RECESSED
SPRINKLER WRENCH

P/N 57 – XXX – X – XXX

		SIN
330	2.8K UPRIGHT (1/2”NPT)	TY1131
331	2.8K PENDENT (1/2”NPT)	TY1231
340	4.2K UPRIGHT (1/2”NPT)	TY2131
341	4.2K PENDENT (1/2”NPT)	TY2231
370	5.6K UPRIGHT (1/2”NPT)	TY3131
371	5.6K PENDENT (1/2”NPT)	TY3231
390	8.0K UPRIGHT (3/4”NPT)	TY4131
391	8.0K PENDENT (3/4”NPT)	TY4231
360	8.0K UPRIGHT (1/2”NPT)	TY4831*
361	8.0K PENDENT (1/2”NPT)	TY4931*

	SPRINKLER FINISH
1	NATURAL BRASS
3	PURE WHITE (RAL9010)*
4	SIGNAL WHITE (RAL9003)
7	LEAD COATED
9	CHROME PLATED
X	JET BLACK (RAL9005)**

	TEMPERATURE RATINGS
135	135°F (57°C)
155	155°F (68°C)
175	175°F (79°C)
200	200°F (93°C)
286	286°F (141°C)

* Eastern Hemisphere sales only.

** Available in only 2.8K, 4.2K, and 8.0K, 155°F (68°C) and 200°F (93°C); requires lead time to manufacture.

TABLE D
SERIES TY-FRB PENDENT AND UPRIGHT SPRINKLERS
PART NUMBER SELECTION

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Sprinkler Assemblies with NPT Thread Connections
Specify: Series TY-FRB (Specify SIN), (specify K-factor), (specify Pendent or Upright) Sprinkler (specify) temperature rating, (specify) finish or coating, P/N (specify from Table D).

Recessed Escutcheon:
Specify: Style (10, 20, 30, or 40) Recessed Escutcheon with (specify*) finish, P/N (specify*).

Sprinkler Wrench
Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.

* Refer to Technical Data Sheet TFP770.

Series TY-FRB — 5.6 K-factor Horizontal and Vertical Sidewall Sprinklers Quick Response, Standard Coverage

General Description

The Series TY-FRB, 5.6 K-factor, Horizontal and Vertical Sidewall Sprinklers described in this data sheet are quick response -standard coverage, decorative 3 mm glass bulb type spray sprinklers designed for use in light and ordinary hazard, commercial occupancies such as banks, hotels, shopping malls, etc. They are designed for installation along a wall or the side of a beam and just beneath a smooth ceiling. Sidewall sprinklers are commonly used instead of pendent or upright sprinklers due to aesthetics or building construction considerations, where piping across the ceiling is not desirable.

The recessed version of the Series TY-FRB Horizontal Sidewall Sprinkler is intended for use in areas with a finished wall. It uses a two-piece Style 10 Recessed Escutcheon with 1/2 inch (12,7 mm) of recessed adjustment or up to 3/4 inch (19,1 mm) of total adjustment from the flush sidewall position, or a two-piece Style 20 Recessed Escutcheon with 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush sidewall position. The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the fixed pipe nipples to the sprinklers must be cut.

Corrosion resistant coatings, where applicable, are utilized to extend the life of copper alloy sprinklers beyond that which would otherwise be obtained when exposed to corrosive atmospheres. Although corrosion resistant coated sprinklers have passed the standard corrosion tests of the applicable approval agencies, the testing is not representative of all possible corrosive atmospheres. Consequently, it is recommended that the end user be consulted with respect to the suitability of these coatings for any given corrosive environment. The effects of ambient temperature, concentration of chemicals, and gas/chemical velocity, should be considered, as a minimum, along with the corrosive nature of the chemical to which the sprinklers will be exposed.

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

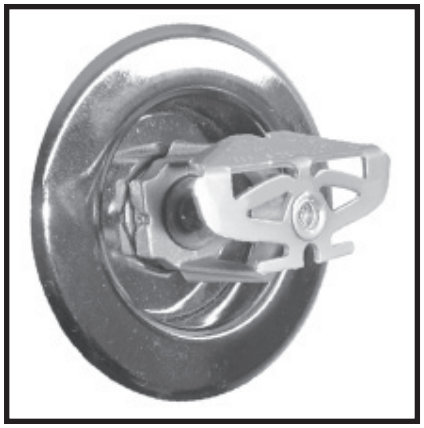
NOTICE

The Series TY-FRB Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Sprinkler Identification Numbers

TY3331 - Horizontal
TY3431 - Vertical



Technical Data

Approvals

UL and C-UL Listed.
FM, LPCB, and NYC Approved.
(Refer to Table A for complete approval information including corrosion resistant status.)

Maximum Working Pressure
Refer to Table B.

Discharge Coefficient
K=5.6 GPM/psi$^{1/2}$ (80,6 LPM/bar$^{1/2}$)

Temperature Ratings
Refer to Table A.

Finishes
Sprinkler: Refer to Table A.
Recessed Escutcheon: Signal or Pure White, Chrome Plated, or Brass Plated.

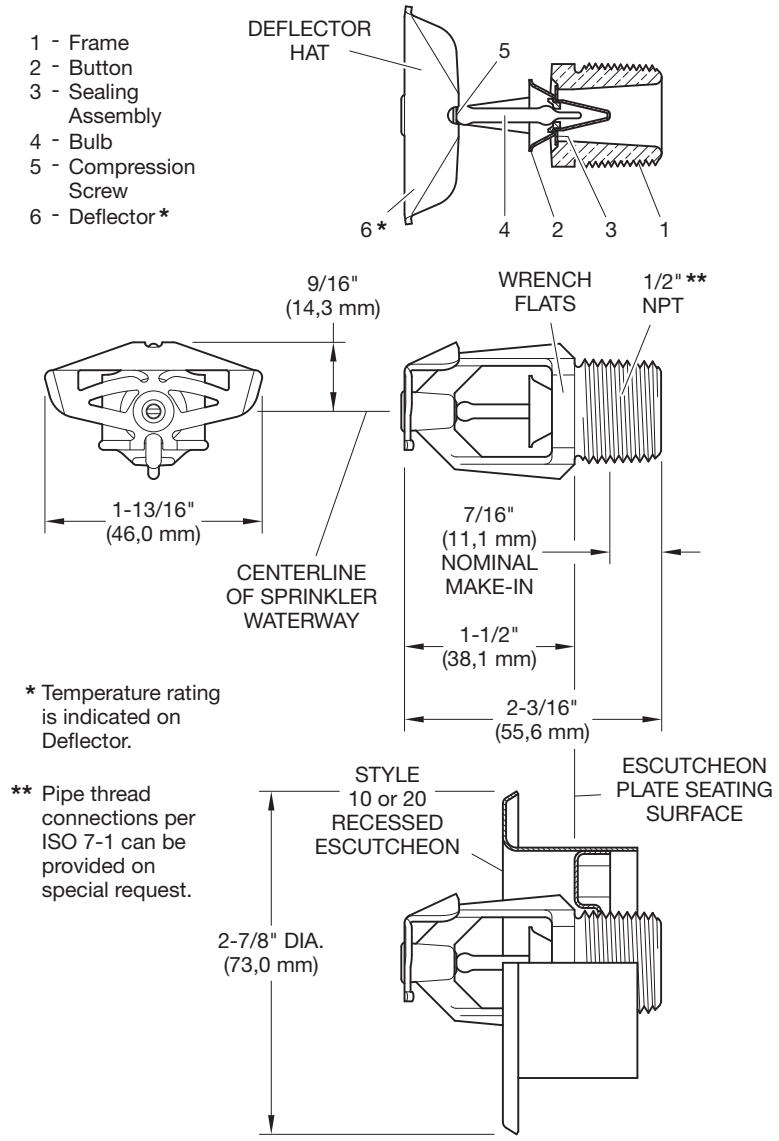


FIGURE 1
5.6 K-FACTOR QUICK RESPONSE
SERIES TY-FRB HORIZONTAL SIDEWALL (TY3331) SPRINKLERS

Physical Characteristics

Frame	Bronze
Button	Brass/Copper
Sealing Assembly	Beryllium Nickel w/TEFLON
Bulb	Glass
Compression Screw	Bronze
HSW Deflector	Bronze
VSW Deflector	Copper

Operation

The glass bulb contains a fluid which expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, allowing the sprinkler to activate and water to flow.

Design Criteria

The Series TY-FRB, 5.6 K-factor, Horizontal and Vertical Sidewall Sprinklers are intended for fire protection systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency (e.g., UL Listing is based on the requirements of NFPA 13, and FM Approval is based on the requirements of FM's Loss Prevention Data Sheets). Only the Style 10 or 20 Recessed Escutcheon, as applicable, is to be used for recessed horizontal installations.

Installation

The Series TY-FRB, 5.6 K-factor, Horizontal and Vertical Sidewall Sprinklers must be installed in accordance with this section.

General Instructions

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm) for the 135°F (57°C) to 3/32 inch (2,4 mm) for the 286°F (141°C) temperature ratings.

A leak tight 1/2 inch NPT sprinkler joint should be obtained with a torque of 7 to 14 ft.-lbs. (9,5 to 19,0 Nm). A maximum of 21 ft.-lbs. (28,5 Nm) of torque may be used to install sprinklers with 1/2 NPT connections. Higher levels of torque may distort the sprinkler and cause leakage or impairment of the sprinkler.

Do not attempt to make-up for insufficient adjustment in the escutcheon plate by under-or over-tightening the sprinkler. Readjust the position of the sprinkler fitting to suit.

Series TY-FRB Horizontal and Vertical Sidewall Sprinkler Installation

The Series TY-FRB Horizontal and Vertical Sidewall Sprinklers must be installed in accordance with the following instructions.

Step 1. Horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word "TOP" on the Deflector is to face towards the ceiling.

Vertical sidewall sprinklers are to be installed in the pendent or upright position with the arrow on the Deflector pointing away from the wall.

Step 2. With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Ref. Figure 5), With reference to Figure 1 or 2, the W-Type 6 Sprinkler Wrench is to be applied to the wrench flats.

Series TY-FRB Recessed Horizontal Sidewall Sprinkler Installation

The Series TY-FRB Recessed Horizontal Sidewall Sprinklers must be installed in accordance with this section.

Step A. Recessed horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word "TOP" on the Deflector is to face towards the ceiling.

Step B. After installing the Style 10 or 20 Mounting Plate over the sprinkler threads, hand tighten the sprinkler into the sprinkler fitting.

Step C. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Ref. Figure 6). With reference to Figure 1, the W-Type 7 Recessed Sprinkler Wrench is to be applied to the sprinkler wrench flats.

Step D. After the ceiling has been installed or the finish coat has been applied, slide on the Style 10 or 20 Closure over the Series TY-FRB Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling.

Care and Maintenance

The Series TY-FRB, 5.6 K-factor, Horizontal and Vertical Sidewall Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Absence of an escutcheon, which is used to cover a clearance hole, may delay the time to sprinkler operation in a fire situation.

Sprinklers that are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced

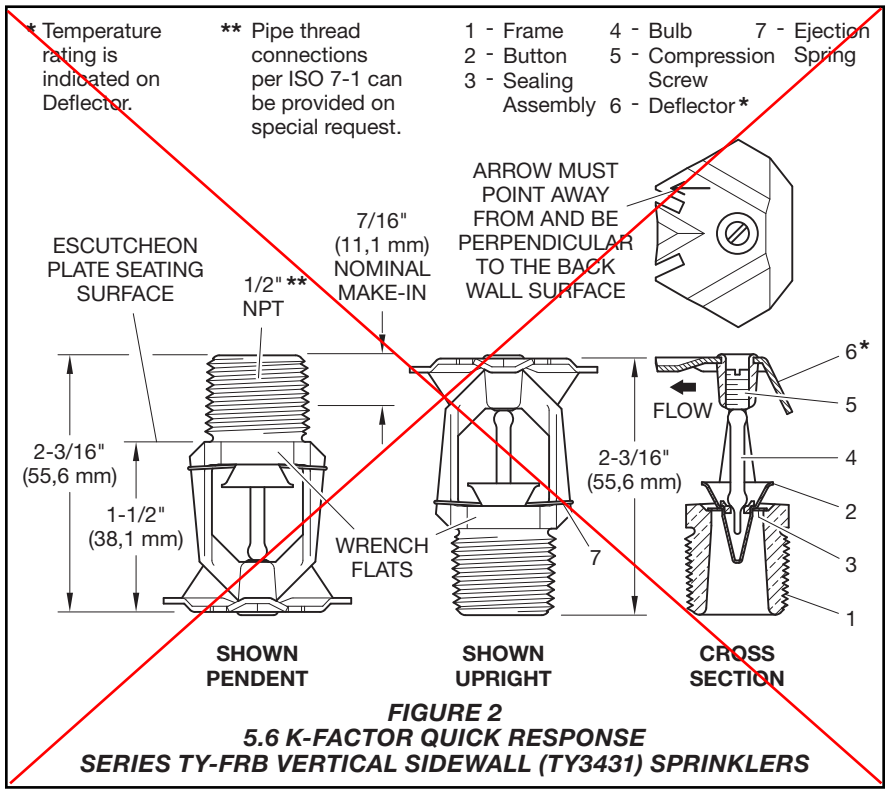


FIGURE 2
5.6 K-FACTOR QUICK RESPONSE
SERIES TY-FRB VERTICAL SIDEWALL (TY3431) SPRINKLERS

if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers -before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

The owner must assure that the sprinklers are not used for hanging of any objects; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Frequent visual inspections are recommended to be initially performed for corrosion resistant coated sprinklers, after the installation has been completed, to verify the integrity of the corrosion resistant coating. Thereafter, annual inspections per NFPA 25 should suffice; however, instead of inspecting from the floor level, a random sampling of close-up visual inspections should be made, so as to better determine the exact sprinkler condition and the long term integrity of the corrosion resistant coating, as it may be affected by the corrosive conditions present.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

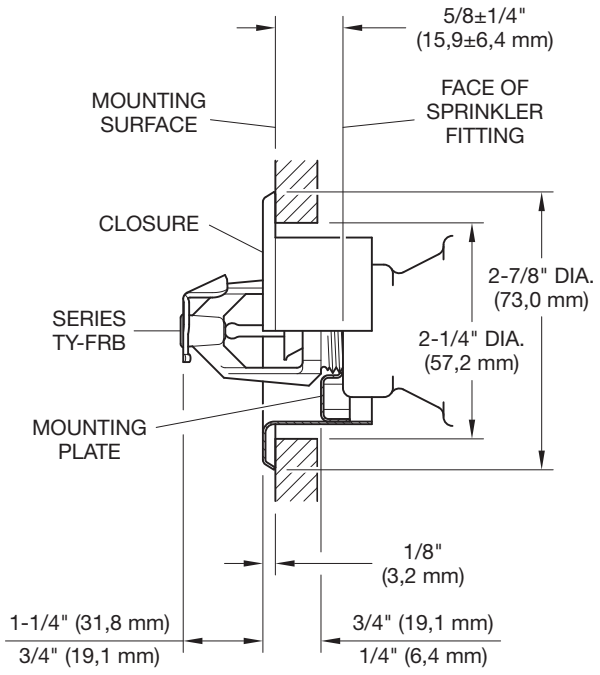


FIGURE 3
SERIES TY-FRB RECESSED HORIZONTAL SIDEWALL SPRINKLER WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT STYLE 10 RECESSED ESCUTCHEON

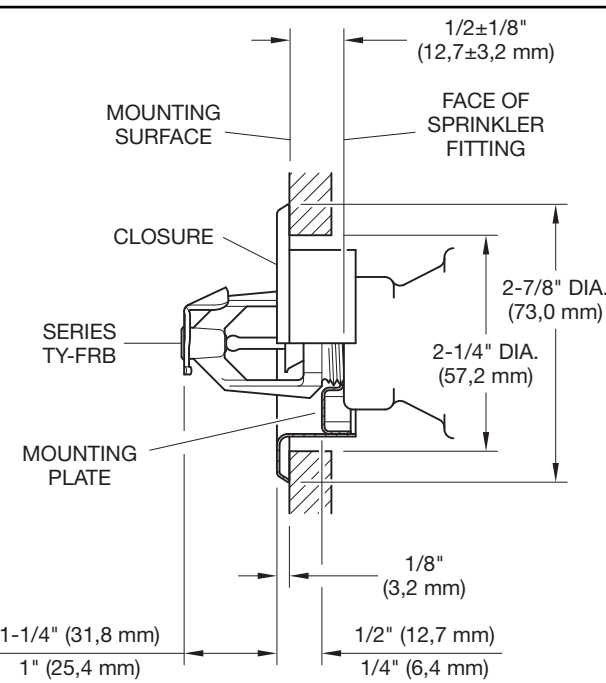


FIGURE 4
SERIES TY-FRB RECESSED HORIZONTAL SIDEWALL SPRINKLER WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT STYLE 20 RECESSED ESCUTCHEON

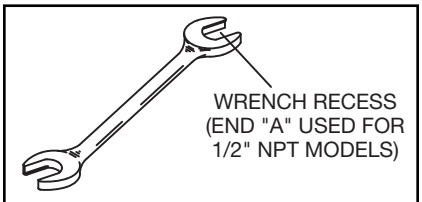


FIGURE 5
W-TYPE 6 SPRINKLER WRENCH

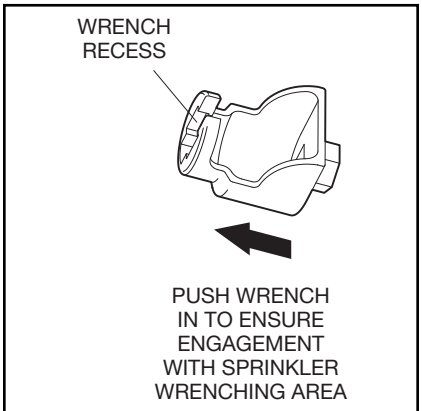


FIGURE 6
W-TYPE 7 RECESSED SPRINKLER WRENCH

				SPRINKLER FINISH (See Note 11)			
K	**TYPE**	**TEMP.**	**BULB LIQUID**	**NATURAL BRASS**	**CHROME PLATED**	**SIGNAL WHITE*** **	**LEAD COATED**
5.6 1/2" NPT	**HORIZ. SIDEWALL (TY3331)**	135°F (57°C)	Orange	1, 2, 3, 4, 9, 10		1, 2, 3, 9	1, 2, 3, 9
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
	RECESSED HORIZ. SIDEWALL (TY3331)* Figure 3	135°F (57°C)	Orange	1, 2, 4, 9, 10		1, 2, 9	N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
	RECESSED HORIZ. SIDEWALL (TY3331) Figure 4**	135°F (57°C)	Orange	1, 2, 3, 4, 9			N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
5.6 1/2" NPT	**VERTICAL SIDEWALL (TY3431) Installed Pendent or Upright**	135°F (57°C)	Orange	5, 6, 7, 8, 9			5, 6, 7, 9
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				
		286°F (141°C)	Blue				

NOTES:

1. Listed by Underwriters Laboratories, Inc. (UL) as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies at a 4 to 12 inch (100 to 300 mm) top of deflector to ceiling distance.
2. Listed by Underwriters Laboratories Inc. for use in Canada (C-UL) as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies at a 4 to 12 inch(100 to 300 mm) top of deflector to ceiling distance.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers for use in Light Hazard Occupancies at a 4 to 12 inch (100 to 300 mm) top of deflector to ceiling distance.
4. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 007a/04) at a 4 to 6 inch (100 to 150 mm) top of deflector to ceiling distance. The LPC does not rate the thermal sensitivity of horizontal sidewall sprinklers.
5. Listed by Underwriters Laboratories, Inc. as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies.
6. Listed by Underwriters Laboratories for use in Canada (C-UL) as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies.
7. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers for use in Light Hazard Occupancies.
8. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06 & 007a/04) as Quick Response Sprinklers.
9. Approved by the City of New York under MEA 354-01-E.
10. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06) at a 4 to 6 inch (100 to 150 mm) top of deflector to ceiling distance. The LPC does not rate the thermal sensitivity of horizontal sidewall sprinklers.
11. Where Polyester Coated and Lead Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion Resistant Sprinklers. Where Lead Coated Sprinklers are noted to be FM Approved, the sprinklers are FM Approved as Corrosion Resistant Sprinklers.

* Installed with Style 10 (1/2" NPT) 3/4" Total Adjustment Recessed Escutcheon.
** Installed with Style 20 (1/2" NPT) 1/2" Total Adjustment Recessed Escutcheon.
*** Frame and deflector only. Listings and approvals apply to color (Special Order).

TABLE A
LABORATORY LISTINGS AND APPROVALS

K	TYPE	SPRINKLER FINISH			
		NATURAL BRASS	CHROME PLATED	WHITE POLYES-TER	LEAD COATED
5.6 1/2" NPT	HORIZONTAL SIDEWALL (TY3331)	250 PSI (17,2 BAR) or 175PSI (12,1 BAR) (SEE NOTE 1)		175 PSI (12,1 BAR)	
	RECESSED HORIZ. SIDEWALL (TY3331)			N/A	
	VERTICAL SIDEWALL (TY3431)	175 PSI (12,1 BAR)			

NOTES:

1. The maximum working pressure of 250 psi (17,2 bar) only applies to the Listing by Underwriters Laboratories, Inc. (UL); the Listing by Underwriters Laboratories, Inc. for use in Canada (C-UL); and, the Approval by the City of New York.

TABLE B
MAXIMUM WORKING PRESSURE

P/N 57 - XXX - X - XXX

		S/N
378	HORIZONTAL SIDEWALL	TY3331
375	VERTICAL SIDEWALL	TY3431

	Sprinkler
1	Natural Brass
3	Pure White (RAL 9010)*
4	Signal White (RAL9003)
X	Jet Black (RAL9005)**
7	Lead Coated
9	Chrome Plated

*Eastern Hemisphere sales only

** Available in 155°F (68°C) or 200°F (93°C) temperature rating only.

	TEMPERATURE RATING
135	135°F (57°C)
155	155°F (68°C)
175	175°F (79°C)
200	200°F (93°C)
286	286°F (141°C)

TABLE C
PART NUMBER SELECTION
SERIES TY-FRB HORIZONTAL AND VERTICAL SIDEWALL SPRINKLERS

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Sprinkler Assemblies with NPT Thread Connections:

Specify: Series TY-FRB (specify SIN), (specify K-factor), (specify) Horizontal Sidewall or Vertical Sidewall Sprinkler, Standard Response, Standard Coverage, (specify) temperature rating, (specify) finish or coating, P/N (specify from Table C)

Recessed Escutcheon:

Specify: Style (10 or 20) Recessed Escutcheon with (specify*) finish, P/N (specify*).

* Refer to Technical Data Sheet TFP770.

Sprinkler Wrench:

Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.

Technical Services
800-381-9312
+1-401-781-8220
www.tyco-fire.com

Series EC-11 & EC-14 — 11.2 and 14.0 K-factor Extended Coverage (Light and Ordinary Hazard) Upright, Pendent, and Recessed Pendent Sprinklers

General Description

The TYCO Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers are decorative glass bulb sprinklers designed for use in light or ordinary hazard occupancies. They are intended for use in automatic sprinkler systems designed in accordance with standard installation rules (for example, NFPA 13) for a maximum coverage area of 400 ft^2 (37,2 m^2), as compared to the maximum coverage area of 130 ft^2 (12,1 m^2) for standard coverage sprinklers used in ordinary hazard occupancies or 225 ft^2 (20,6 m^2) for standard coverage sprinklers used in light hazard occupancies.

The Series EC-11 and EC-14 Sprinklers feature a UL and C-UL Listing that permits their use with unobstructed or non-combustible obstructed ceiling construction as defined and permitted by NFPA 13, as well as a specific application listing for use under concrete tees.

The Series EC-11 and EC-14 Extended Coverage Sprinklers have been fire tested to compare their performance to that of standard coverage spray sprinklers. These tests have shown that the protection provided is equal to or more effective than standard coverage spray sprinklers.

Corrosion resistant coatings, where applicable, are utilized to extend the life of copper alloy sprinklers beyond that which would otherwise be obtained when exposed to corrosive atmospheres. Although corrosion resistant coated sprinklers passed standard corrosion tests of the applicable approval agencies, the testing is not representative of all possible corrosive atmospheres. Consequently, it is recommended that the end user be consulted with respect to the suitability of these corrosion resistant coatings for any given corrosive environment. The effects of ambient temperature, concentration of chemicals, and gas/chemical velocity should be considered, as a minimum, along with the corrosive nature of the chemical to which the sprinklers will be exposed.

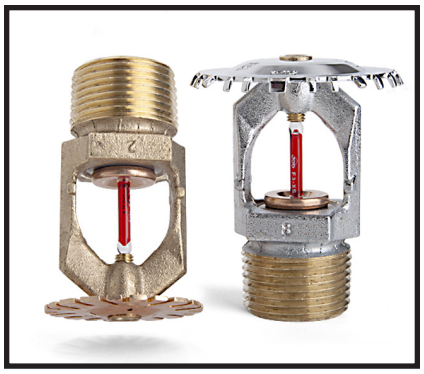
NOTICE

The Series EC-11 and EC-14 Extended Coverage Sprinklers described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.



Sprinkler Identification Numbers (SINs)

TY5137 - Upright, 11.2K

TY5237 - Pendent, 11.2K

TY6137 - Upright, 14.0K

TY6237 - Pendent,14.0K

TY5137 is a redesignation for C5137, G1894, and S2510.

TY5237 is a redesignation for C5237, G1893, and S2511.

TY6137 is a redesignation for C6137, G1896, and S2610.

TY6237 is a redesignation for C6237, G1895, and S2611.

1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector

* Temperature rating is indicated on deflector

** Pipe thread connections per ISO 7/1 can be provided on special request.

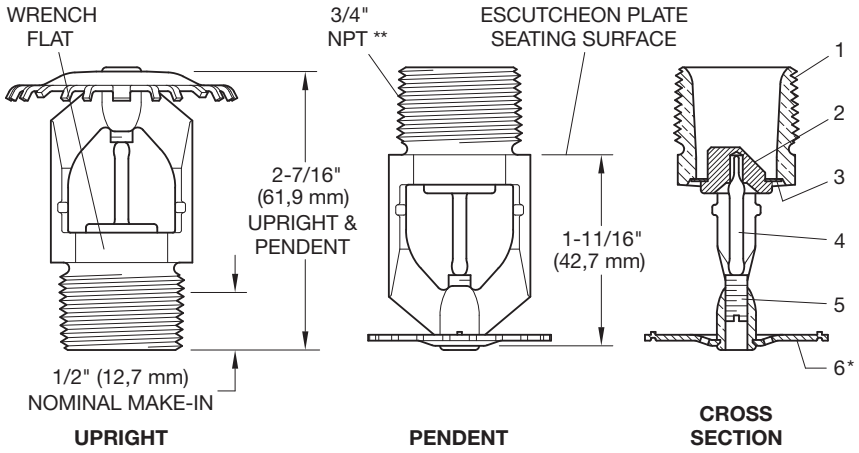


FIGURE 1
SERIES EC-11 AND EC-14 EXTENDED COVERAGE SPRINKLERS
11.2 K-FACTOR UPRIGHT (TY5137) AND PENDENT (TY5237)
14.0 K-FACTOR UPRIGHT (TY6137) AND PENDENT (TY6237)
— ASSEMBLY —

Hazard	Type	Temperature	Bulb Liquid	Sprinkler Finish (See Note 5)			
				Natural Brass	Chrome Plated	White* Polyester	Lead Coated
Light **Refer to Table B for UL and C-UL Sensitivity Rating** **Refer to Table C for FM Sensitivity Rating**	Upright K=11.2 (TY5137) Pendent K=11.2 (TY5237) K=14.0 (TY6237)	135°F (57°C)	Orange	1, 2, 3**, 4			
		155°F (68°C)	Red				
		175°F (79°C)	Yellow	1, 2, 4			1, 2, 4
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
	Recessed Pendent K=11.2 (TY5237) K=14.0 (TY6237) With Style 30 Escutcheon	135°F (57°C)	Orange	1, 2, 3, 4			N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow	1, 2, 4			
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
Ordinary **Refer to Table B for UL and C-UL Sensitivity Rating** **Refer to Table C for FM Sensitivity Rating**	Upright K=11.2 (TY5137) K=14.0 (TY6137) Pendent K=11.2 (TY5237) K=14.0 (TY6237)	135°F (57°C)	Orange	1, 2, 3, 4			1, 2, 3, 4
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				1, 2, 4
		200°F (93°C)	Green				
		286°F (141°C)	Blue				
	Recessed Pendent K=11.2 (TY5237) K=14.0 (TY6237) With Style 40 Escutcheon	135°F (57°C)	Orange	1, 2, 4			N/A
		155°F (68°C)	Red				
		175°F (79°C)	Yellow				
		200°F (93°C)	Green				

Notes:
1. Listed by Underwriters Laboratories, Inc. (UL)
2. Listed by Underwriters Laboratories, Inc. for use in Canada (C-UL)
3. Approved by Factory Mutual Research Corporation (FM)
4. Approved by the City of New York under MEA 177-03- E
5. Where Polyester Coated or Lead Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion Resistant Sprinklers

* Frame and Deflector only. Listings and approvals apply to color (Special Order)

** Pendent Only

N/A: Not Available

TABLE A
— LABORATORY LISTINGS AND APPROVALS —

Area	Style	Light Hazard					Ordinary Hazard				
		135°F (57°C)	155°F (68°C)	175°F (79°C)	200°F (93°C)	286°F (141°C)	135°F (57°C)	155°F (68°C)	175°F (79°C)	200°F (93°C)	286°F (141°C)
14 x 14	Upright or Pendent	-	-	-	-	-	QR	QR	QR	QR	SR
	Style 30 Recessed	-	-	-	-	-	QR	QR	QR	QR	N/A
	Style 40 Recessed	-	-	-	-	-	QR	QR	QR	QR	N/A
16 x 16	Upright or Pendent	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
	Style 30 Recessed	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	N/A
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	N/A
18 x 18	Upright or Pendent	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
	Style 30 Recessed	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	N/A
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	N/A
20 x 20	Upright or Pendent	QR*	QR*	QR*	SR*	SR*	SR	SR	SR	SR	SR
	Style 30 Recessed	QR*	QR*	QR*	SR*	SR*	SR	SR	SR	SR	N/A
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	N/A

QR: Quick Response
SR: Standard Response
N/A: Not Applicable
* Does not apply to Upright K=14.0

TABLE B
SENSITIVITY RATING FOR UL AND C-UL LISTING OF SERIES EC-11 OR EC-14 SPRINKLERS
(Refer to Table D for Permitted K-Factor/Area Combinations)

Area	Style	Light Hazard					Ordinary Hazard				
		135°F (57°C)	155°F (68°C)	175°F (79°C)	200°F (93°C)	286°F (141°C)	135°F (57°C)	155°F (68°C)	175°F (79°C)	200°F (93°C)	286°F (141°C)
14 x 14	Upright or Pendent	-	-	-	-	-	SR	SR	SR	SR	SR
	Style 30 Recessed	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A
	Style 40 Recessed	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A
16 x 16	Upright or Pendent	QR*	QR*	N/A	N/A	N/A	SR	SR	SR	SR	SR
	Style 30 Recessed	QR*	QR*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18 x 18	Upright or Pendent	QR*	QR*	N/A	N/A	N/A	SR	SR	SR	SR	SR
	Style 30 Recessed	QR	QR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20 x 20	Upright or Pendent	QR*	QR*	N/A	N/A	N/A	SR	SR	SR	SR	SR
	Style 30 Recessed	QR	QR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

QR: Quick Response
SR: Standard Response
N/A: Not Applicable
* Does not apply to Upright K=14.0

TABLE C
SENSITIVITY RATING FOR FM APPROVAL OF SERIES EC-11 OR EC-14 SPRINKLERS
(Refer to FM Loss Prevention Data Sheet 2-8N for Permitted K-Factor/Area Combinations)

Technical Data

Approvals
Refer to Table A for approval information on the TYCO Series EC-11 and EC-14 Sprinklers, as well as the TYCO Style 30 and Style 40 Two-Piece Recessed Escutcheons. The approvals apply to the service conditions indicated in the Design Criteria section.

The TYCO Style 60 Two-Piece Flush Escutcheon (Figure 4) is UL Listed and FM Approved for use with the Series EC-11 and EC-14 Pendent Sprinklers.

Maximum Working Pressure
175 psi (12,1 bar)

Pipe Thread Connection
3/4 inch NPT

Discharge Coefficients
- K = 11.2 GPM/psi$^{1/2}$ (161,3 LPM/bar$^{1/2}$)
- K = 14.0 GPM/psi$^{1/2}$ (201,6 LPM/bar$^{1/2}$)

Temperature Ratings
135°F (57°C) to 286°F (141°C)

Finish
- Sprinkler: Refer to Table A.
- Recessed or Flush Escutcheon: White Coated, Chrome Plated, and Brass-Plated

Physical Characteristics

Frame	Bronze
Button	Bronze
Sealing Assembly	Beryllium Nickel w/TEFLON
Bulb	Glass (3 mm dia.)
Compression Screw	Bronze
Deflector	Brass

Operation

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, which then allows the sprinkler to activate and flow water.

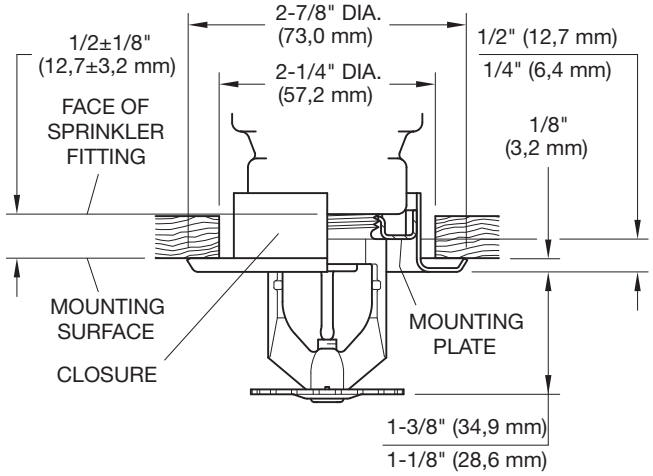


FIGURE 2
SERIES EC-11 AND EC-14 RECESSED PENDENT SPRINKLER ASSEMBLY WITH TWO-PIECE 1/2-INCH TOTAL ADJUSTMENT STYLE 30 RECESSED ESCUTCHEON

Design Criteria

The TYCO Series EC-11 and EC-14 Extended Coverage Sprinklers must only be installed in accordance with the applicable UL and C-UL Listing or FM Approval requirements as indicated below. Only the Style 30 or 40 Recessed Escutcheon is to be used for recessed installation, as applicable (Refer to Tables A, B, and C).

UL and C-UL Listing Requirements

- The Series EC-11 and EC-14 Sprinklers may be used for the coverage areas shown in Table D, based on maintaining the minimum specified flow rate as a function of coverage area and hazard group for all sprinklers in the design area.
- The Series EC-11 and EC-14 Sprinklers are permitted to be used with unobstructed or non-combustible obstructed ceiling construction as defined and permitted by NFPA 13. For example:
  - Unobstructed, combustible or non-combustible, ceiling construction with a deflector to ceiling/roof deck distance of 1 to 12 inches (25 to 300 mm).
  - Obstructed, non-combustible, ceiling construction with a deflector location below structural members of 1 to 6 inches (25 to 150 mm) and a maximum deflector to ceiling/roof deck distance of 22 inches (550 mm).
- The Series EC-11 and EC-14 Sprinklers, specifically tested and listed for non-combustible obstructed construction, are permitted to be used within trusses or bar joists having non-combustible web members greater than 1 inch (25.4 mm) when applying the 4 times obstruction criteria rule defined under "Obstructions to Sprinkler Discharge Pattern Development".
- The minimum allowable spacing, to prevent cold soldering between Series EC-11 and EC-14 Sprinklers, is 8 feet (2,4 m) for upright sprinklers and 9 feet (2,7 m) for pendent sprinklers.
- The Series EC-11 and EC-14 Sprinklers are to be installed in accordance with all other requirements of NFPA 13 for extended coverage upright and pendent sprinklers, For example; obstructions to sprinkler discharge, obstructions to sprinkler pattern development, obstructions to prevent sprinkler discharge from reaching hazard, clearance to storage, etc.

UL and C-UL Specific Application Listing Requirements for Installation under Concrete Tees
The Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers (TY5137, TY5237, TY6137 and TY6237) have a UL and C-UL Specific Application Listing for use under concrete tees when installed as follows:

- The stems of the concrete tee construction must spaced at less than 7.5 feet (2,3 m) on center but

more than 3 feet (0,9 m) on center. The depth of the concrete tees must not exceed 30 inches (762 mm). The maximum permitted concrete tee length is 32 feet (9,8 m); however, where the concrete tee length exceeds 32 feet (9,8 m), non-combustible baffles, equal in height to the depth of the tees, can be installed so that the space between the tees does not exceed 32 feet (9,8 m) in length.

- The sprinkler deflectors are to be located in a horizontal plane at or above 1 inch (25,4 mm) below the bottom of the concrete tee stems.
- When the sprinkler deflectors are located higher than a horizontal plane 1 inch (25,4 mm) beneath the bottom of the concrete tee stems, the obstruction to sprinkler discharge criteria requirements of NFPA 13 for extended coverage upright sprinklers applies.

FM Approval Requirements

The Series EC-11 and EC-14 Extended Coverage Sprinklers are to be installed in accordance with the applicable Factory Mutual Loss Prevention Data Sheet for limited use in buildings of specific roof construction and for the protection of certain specific ordinary hazard (non-storage and/or non-flammable or combustible liquid) occupancies. Information provided in the FM Loss Prevention Data Sheets relates to, but not limited to, hydraulic design, ceiling slope, and obstructions, minimum and maximum allowable spacing, and deflector-to-ceiling distance.

These criteria may differ from UL and/or NFPA criteria; therefore, the designer must review and become familiar with Factory Mutual requirements before proceeding with design.

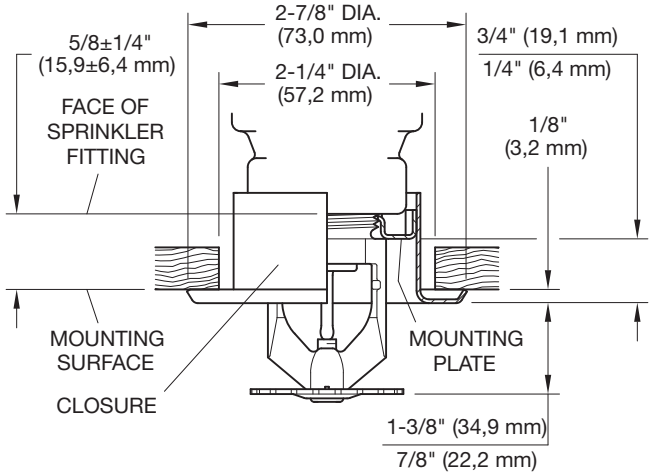


FIGURE 3
SERIES EC-11 AND EC-14 RECESSED PENDENT SPRINKLER ASSEMBLY WITH TWO-PIECE 3/4-INCH TOTAL ADJUSTMENT STYLE 40 RECESSED ESCUTCHEON

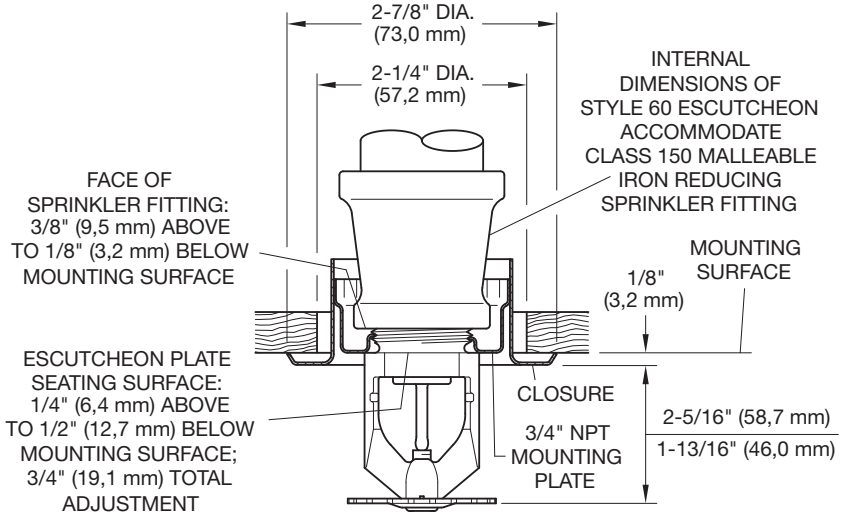


FIGURE 4
SERIES EC-11 AND EC-14 PENDENT SPRINKLER ASSEMBLY WITH 3/4-INCH TOTAL ADJUSTMENT STYLE 60 TWO-PIECE FLUSH ESCUTCHEON

Installation

The TYCO Series EC-11 and EC-14 Sprinklers must be installed in accordance with the following instructions:

NOTICE

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm) for the 135°F (57°C) to 3/32 inch (2,4 mm) for the 286°F (141°C) temperature ratings.

A 3/4 inch NPT sprinkler joint should be obtained with a minimum-to-maximum torque of 10 to 20 ft.lbs. (13,4 to 26,8 Nm). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under or over-tightening the Sprinkler. Re-adjust the position of the sprinkler fitting to suit.

Step 1. The sprinkler must be installed with the deflector parallel to the mounting surface. Pendent sprinklers must be installed in the pendent position, and upright sprinklers must be installed in the upright position.

Step 2. After installing the Style 30, 40, or 60 mounting plate (or other escutcheon, as applicable) over the sprinkler pipe threads and with pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step 3. Wrench tighten upright or pendent sprinklers using only the W-Type 3 (End A) Sprinkler Wrench. When installing the pendent sprinkler with Style 30, 40, or 60 Escutcheon, wrench tighten the sprinkler using only the W-Type 22 Sprinkler Wrench. The wrench recess of the applicable sprinkler wrench (Ref. Figure 5 and 6) is to be applied to the sprinkler wrench flats (Ref. Figure 1).

Care and Maintenance

The TYCO Series EC-11 and EC-14 Sprinklers must be maintained and serviced in accordance with the following instructions:

NOTICE

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection systems must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Exercise care to avoid damage to sprinklers before, during, and after installation. Never paint, plate, coat, or otherwise alter automatic sprinklers after they leave the factory. Modified sprinklers must be replaced.

Also sprinklers must be replaced that:

- were damaged by dropping, striking, wrench twisting, wrench slippage, or the like;
- are leaking or exhibiting visible signs of corrosion;
- were exposed to corrosive products of combustion but have not operated, if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush; or
- have a cracked Bulb or have lost liquid from the Bulb. Refer to the Installation section in this data sheet.

Frequent visual inspections are recommended to be initially performed for corrosion resistant coated sprinklers, after the installation has been completed, to verify the integrity of the corrosion resistant coating. Thereafter, annual inspections per NFPA 25 should suffice; however, instead of inspecting from the floor level, a random sampling of close-up visual inspections should be made, so as to better determine the exact sprinkler condition and the long term integrity of the corrosion resistant coating, as it may be affected by the corrosive conditions present.

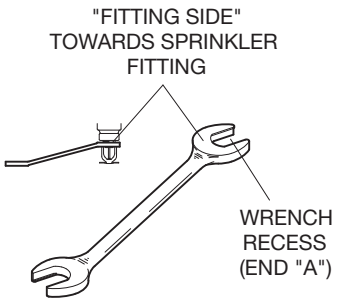


FIGURE 5
W-TYPE 3 SPRINKLER WRENCH

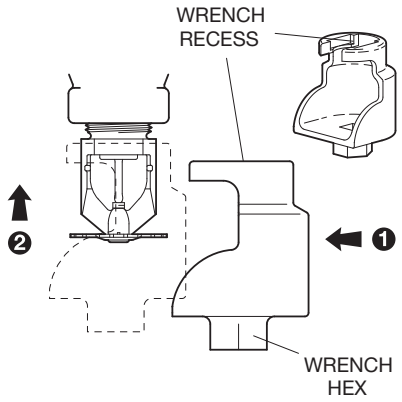


FIGURE 6
W-TYPE 22 RECESSED SPRINKLER WRENCH

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards recognized by the Approval agency (for example, NFPA 25), in addition to the standards of any authorities having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Description	Area	Light Hazard 0.10 GPM/ft²		Group I Ordinary Hazard 0.15 GPM/ft²		Group II Ordinary Hazard 0.20 GPM/ft²	
		GPM	PSI	GPM	PSI	GPM	PSI
TY5137 (K=11.2) Upright	14 x 14	-	-	30	7.2	39	12.1
	16 x 16	30	7.2	39	12.1	51	20.7
	18 x 18	33	8.7	49	19.1	65	33.7
	20 x 20	40	12.8	60	28.7	80	51.0
TY5237 (K=11.2) Pendent	14 x 14	-	-	30	7.2	39	12.1
	16 x 16	30	7.2	39	12.1	51	20.7
	18 x 18	33	8.7	49	19.1	65	33.7
	20 x 20	40	12.8	60	28.7	80	51.0
TY6137 (K=14.0) Upright	14 x 14	N/A	N/A	-	-	-	-
	16 x 16	N/A		39	7.8	51	13.3
	18 x 18	N/A	N/A	49	12.3	65	21.6
	20 x 20	N/A	N/A	60	18.4	80	32.7
TY6237 (K=14.0) Pendent	14 x 14	-	-	-	-	-	-
	16 x 16	37	7.0	39	7.8	51	13.3
	18 x 18	37	7.0	49	12.3	65	21.6
	20 x 20	40	8.2	60	18.4	80	32.7

1 ft. = 0.3048 m
1 ft.² =0.093 m²
1 GPM = 3.785 LPM

1 psi = 0.06895 bar
1 GPM/ft² = 40.74 mm/min

TABLE D
FLOW CRITERIA FOR UL AND C-UL LISTING OF SERIES EC-11 AND EC-14 SPRINKLERS

P/N 51 – XXX – X – XXX

		SIN
893	11.2K Pendent	TY5237
894	11.2K Upright	TY5137
895	14.0K Pendent	TY6237
896	14.0K Upright	TY6137

	Sprinkler Finish
1	Natural Brass
4	White Polyester
7	Lead Coated
9	Chrome-Plated

	Temperature Rating
135	135°F (57°C)
155	155°F (68°C)
175	175°F (79°C)
200	200°F (93°C)
286	286°F (141°C)

TABLE E
PART NUMBERS FOR
SERIES EC-11 AND EC-14 SPRINKLERS

Limited Warranty

Products manufactured by Tyco Fire Protection Products (TFPP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFPP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFPP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFPP to be defective shall be either repaired or replaced, at TFPP's sole option. TFPP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFPP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFPP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFPP was informed about the possibility of such damages, and in no event shall TFPP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name, description, and P/N. Refer to the Price List for complete listing of Part Numbers.

Sprinkler Assemblies with NPT Thread Connections
Specify (SIN), (K-Factor), (temperature rating), (Pendent or Upright) Extended Coverage Sprinkler with (finish), P/N. Refer to Table E

Recessed Escutcheon, Two-Piece
Specify Style (30 or 40) Two-Piece Recessed Escutcheon with (material or finish), P/N. Refer to Technical Data Sheet TFP770.

Flush Escutcheon, Two-Piece
Specify Style 60 Two-Piece Flush Escutcheon with (finish), P/N (specify). Refer to Technical Data Sheet TFP778.

Sprinkler Wrenches
Specify W-Type 3 Sprinkler Wrench, P/N 56-895-1-001.

Specify W-Type 22 Recessed Sprinkler Wrench, P/N 56-665-7-001.

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking Standard/Quick Response Extended Coverage Light Hazard Extra-Large Orifice (ECLH-ELO/QRECLH-ELO) Pendent Sprinkler VK608 is a thermosensitive spray sprinkler available in several different finishes and temperature ratings to meet varying design requirements. The glass bulb operating element and special deflector characteristics meet the challenges of quick response extended coverage standards. The sprinkler has both quick response and standard response listings as indicated in the Approval Charts on pages 85c-e. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, ENT coating has been investigated for installation in corrosive atmospheres. See Approval Charts.

For Light Hazard Occupancies

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class 2020

NYC Approved: MEA 89-92-E, Volume 9

Refer to Approval Chart 1 and Design Criteria on pages 85c-d for cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria on page 85e for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Available since 1993.
Minimum Operating Pressure: Refer to the Approval Charts.
Maximum Working Pressure: 175 psi (12 Bar). Factory tested hydrostatically to 500 psi (34.5 bar).
Factory tested hydrostatically to 500 psi (34.5 bar).
Thread size: 3/4" (20 mm) NPT
Nominal K-Factor: 11.2 U.S. (161.3 metric†)

† Metric K-factor measurement shown is in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-5/16" (59 mm)

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards:

Sprinkler Frame: Brass UNS-C84400
Deflector: Brass UNS-C51000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Leaded Bronze UNS-C31600 or UNS-C31400
For PTFE Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-PTFE Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinkler: Belleville Spring-Exposed, Screw and Pipcap-ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Standard/Quick Response Extended Coverage Light Hazard Extra-Large Orifice (ECLH-ELO) Pendent Sprinkler VK608 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.

Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, Black PTFE = N, and ENT=JN
Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D
For example, sprinkler VK608 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 08339AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:

VIKING®

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

A. Standard Wrench: Part No. 05118CW/B (available since 1981)
B. Wrench for recessed pendent sprinkler: Part No. 11663W/B** (available since 2001)
**A ½" ratchet is required (not available from Viking).

Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

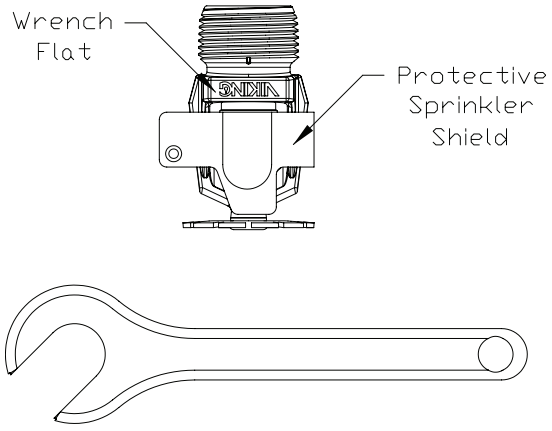


Figure 1:
Standard Sprinkler Wrench 05118CW/B

4. INSTALLATION
Refer to appropriate NFPA and FM Installation Standards.

5. OPERATION
During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE
Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY
Viking Sprinkler VK608 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE
For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow

Sprinkler Finishes: Brass, Chrome, White Polyester[3], Black Polyester[3], Black PTFE[3], and ENT

Corrosion-Resistant Coatings[4]:ENT

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and PTFE coatings. For PTFE coated open sprinklers only, the waterway is coated.

[4] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Chart. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For ENT automatic sprinklers, all exposed surfaces and the waterway are coated, but note that the spring is exposed.

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Sprinkler Base Part Number[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	Overall Length	
		Inches	mm	U.S.	metric[2]		Inches	mm
08339	VK608	3/4	20	11.2	161.3	175 psi (12 Bar)	2-5/16	59

Approval Chart 1 (UL)
Standard/Quick Response Extended Coverage ELO Pendent Sprinkler VK608
For Light Hazard Occupancies

KEY: A1X — Temperature, Finish, Escutcheon (if applicable)

Maximum Sprinkler Spacing (L x W[4])	Maximum Area per Sprinkler	Minimum Water Supply Requirements[4]	Listings and Approvals[3] (Refer also to Design Criteria on page 85d.)	
			cULus[5]	NYC[7]
Standard Response[6]				
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ .88 Bar)	C1Y, C2Z	C1Y
Quick Response				
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	A1Y, D2Z	See Footnote 8.
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	33 gpm @ 8.7 psi (124.9 L/min @ .60 Bar)	A1Y, D2Z	See Footnote 8.
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ .88 Bar)	B1Y, E2Z	See Footnote 8.

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
B - 135 °F (57 °C) and 175 °F (79 °C)
C - 155 °F (68 °C)
D - 155 °F (68 °C), and 175 °F (79 °C)
E - 155 °F (68 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester, Black Polyester, and Black PTFE
2 - ENT[9]

Approved Escutcheons

Y - Standard surface-mounted escutcheons or the Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Micromatic® Model E-1, E-2, or E-3 Recessed Escutcheon
Z - Standard surface-mounted escutcheons or the Micromatic Model E-1 Recessed Escutcheon.

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This chart shows listings and approvals available at time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.
[4] For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" for the next larger area listed. Flows and pressures listed are per sprinkler.
[5] cULus Listed for use in the U.S. and Canada for Light Hazard occupancies only.
[6] Listings are limited to Light Hazard Occupancies where allowed by the installation standards being applied.
[7] Accepted for use, City of New York Department of Buildings, MEA 89-92 Vol. 9.
[8] Meets New York City requirements, effective July 1, 2008.
[9] cULus Listed as corrosion-resistant.

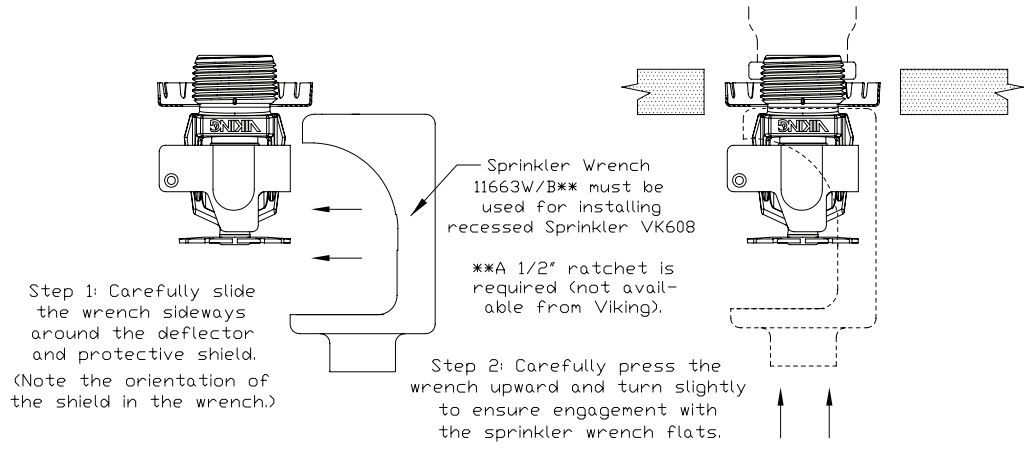


Figure 2: Wrench 11663W/B for Recessed Pendent Sprinkler VK608

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA - UL

(Also refer to the Approval Chart on page 85c.)

cULus Listing Requirements:

Standard/Quick Response Extended Coverage Light Hazard ELO Pendent Sprinkler VK608 is cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for extended coverage pendent spray sprinklers:

- Limited to Light Hazard occupancies, where allowed by the installation standards being applied, with smooth, flat, horizontal ceilings only.
- Minimum spacing allowed is 8 ft. (2.4 m) unless baffles are installed in accordance with NFPA 13.
- Minimum distance from walls is 4 in. (102 mm).
- Maximum distance from walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall.
- The sprinkler installation and obstruction rules contained in NFPA 13 for extended coverage pendent spray sprinklers must be followed.

Also, Viking ECLH-ELO Pendent Sprinkler VK608 is specifically cULus Listed for:

- For non-combustible obstructed construction within trusses or bar joists having non-combustible web members greater than 1" (25.4 mm) when applying the 4 times obstruction criteria rule as defined in NFPA 13 under "Obstructions to Sprinkler Discharge Pattern Development".
- For installation under concrete tees when installed as follows:
  1. The stems of the concrete tee construction must be spaced between 3 ft (0.9 m) and 7 ft-6 in (2.3 m) on center. The depth of the concrete tees must not exceed 30 in (762 mm). The maximum permitted concrete tee length is 32 ft (9.8 m). However, where the concrete tee length exceeds 32 ft (9.8 m), non-combustible baffles, equal in height to the depth of the tees, can be installed so that the space between the tees does not exceed 32 ft (9.8 m).
  2. The sprinkler deflector is to be located in a horizontal plane at or above 1" (25.4 mm) below the bottom of the concrete tee stems.
  3. When the sprinkler deflector is located higher than a horizontal plane 1" (25.4 mm) beneath the bottom of the concrete tee stems, the obstruction to sprinkler discharge criteria requirements of NFPA 13 for extended coverage upright sprinklers applies.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to pages EC1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

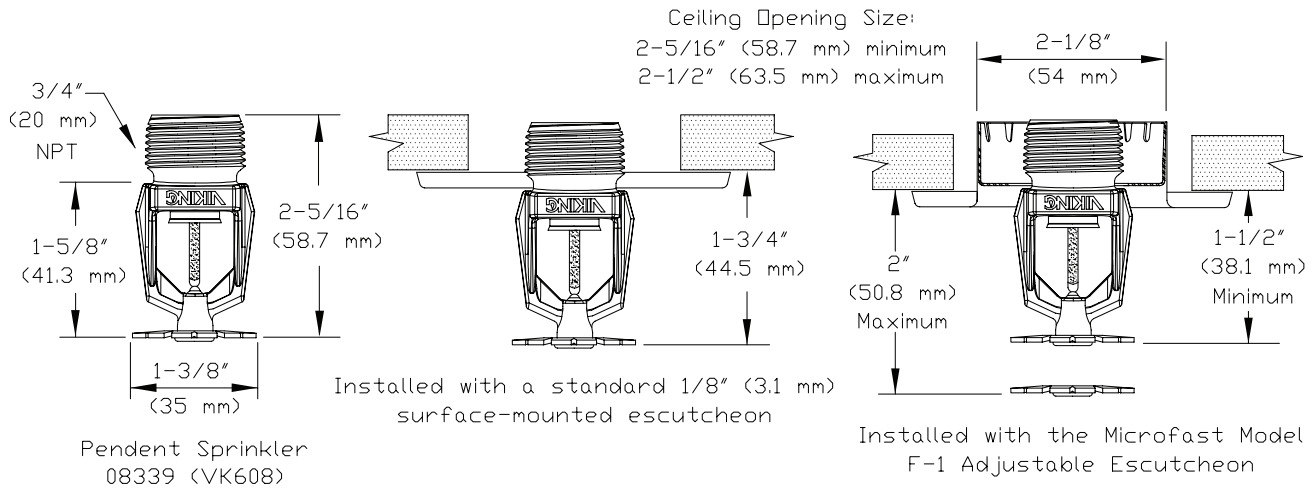


Figure 3: Sprinkler VK608 Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

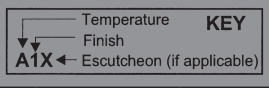
TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Sprinkler Base Part Number[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	Overall Length	
		Inches	mm	U.S.	metric[2]		Inches	mm
08339	VK608	3/4	20	11.2	161.3	175 psi (12 Bar)	2-5/16	59

Approval Chart 2 (FM)
Quick Response Extended Coverage ELO Pendent Sprinkler VK608



Maximum Sprinkler Spacing (L x W[4])	Maximum Area per Sprinkler	Minimum Water Supply Requirements[4]	FM Approvals[3] (Refer also to Design Criteria below.)
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	30 gpm @ 7.2 psi (113.6 L/min @ 0.50 Bar)	B1Y, A1X, D2Z, C2X
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	33 gpm @ 8.7 psi (124.9 L/min @ 0.60 Bar)	B1Y, A1X, D2Z, C2X
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ 0.88 Bar)	B1Y, A1X, D2Z, C2X

Approved Temperature Ratings
A - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
B- 135 °F (57 °C), 155 °F (68 °C)
C - 155 °F (68 °C), and 175 °F (79 °C)
D - 155 °F (68 °C)

Approved Finishes
1 - Brass, Chrome, White Polyester, and Black Polyester
2 - ENT[5]

Approved Escutcheons
X - Standard surface-mounted escutcheons
Y - Standard surface-mounted escutcheons or the Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Micromatic® Model E-1, E-2, or E-3 Recessed Escutcheon
Z - Standard surface-mounted escutcheons or the Micromatic Model E-1 Recessed Escutcheon.

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This chart shows the FM Approvals available at time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.

[4] For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" for the next larger area listed. Flows and pressures listed are per sprinkler.

[5] FM Approved as corrosion-resistant.

DESIGN CRITERIA - FM

(Also refer to the Approval Chart above.)

FM Approval Requirements:

Quick Response Extended Coverage Extra-Large Orifice Pendent Sprinkler VK608 is FM Approved as a quick response extended coverage pendent **Non-Storage** sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to pages EC1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

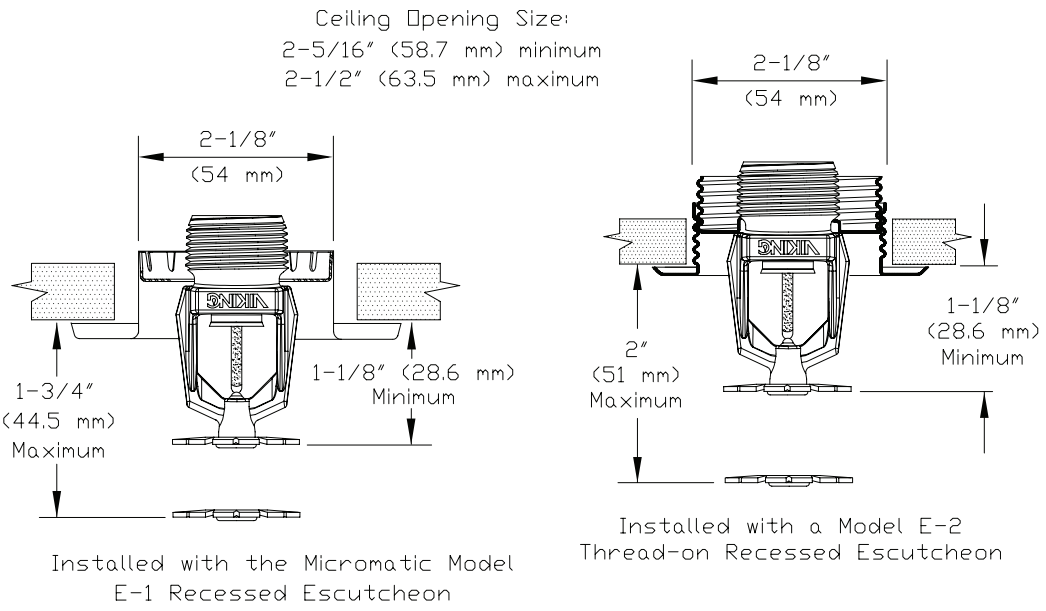


Figure 4: Sprinkler VK608 Dimensions with the Model E-1 and E-2 Recessed Escutcheons

SCHEDULE 10 & SCHEDULE 40

FM APPROVED AND UL LISTED SPRINKLER PIPE

Bull Moose Tube's® Schedule 10 and Schedule 40 are FM Approved and UL Listed (for U.S. and Canada), even though these products do not require separate approvals and listings. Bull Moose Tube® made the decision to have them approved and listed. Our Schedule 10 and Schedule 40 have a pressure rating of 300 PSI and have been through the same rigorous testing as our other fine pipe products. Schedule 10 can be supplied roll grooved or plain end.

Bull Moose Tube's® Schedule 10 and Schedule 40 pipes are made to ASTM A135 and A795. These products are typically supplied with our protective coating, but can be supplied without the coating so they can be hot-dip galvanized to meet FM & UL requirements of ASTM A123

c UL us LISTED

FM APPROVED

NFPA

NFSA

FBC SYSTEM COMPATIBLE

SCHEDULE 10 PIPE SPECIFICATIONS

NOMINAL PIPE SIZE (IN)	O.D. (IN)	I.D. (IN)	CRR**	WEIGHT/FT	WATER FILLED WEIGHT	BUNDLE SIZE
1	1.315	1.097	15.27	1.41 lbs/ft	1.820	91
1-1/4	1.660	1.442	9.91	1.81 lbs/ft	2.518	61
1-1/2	1.900	1.682	7.76	2.09 lbs/ft	3.053	61
2	2.375	2.157	6.27	2.64 lbs/ft	4.223	37
2-1/2	2.875	2.635	4.92	3.53 lbs/ft	5.893	30
3	3.500	3.260	3.54	4.34 lbs/ft	7.957	19
4	4.500	4.260	2.50	5.62 lbs/ft	11.796	19

SCHEDULE 40 PIPE SPECIFICATIONS

NOMINAL PIPE SIZE (IN)	O.D. (IN)	I.D. (IN)	CRR**	WEIGHT/FT	WATER FILLED WEIGHT	BUNDLE SIZE
1	1.315	1.049	1.00	1.68 lbs/ft	2.055	70
1-1/4	1.660	1.380	1.00	2.27 lbs/ft	2.918	51
1-1/2	1.900	1.610	1.00	2.72 lbs/ft	3.602	44
2	2.375	2.067	1.00	3.66 lbs/ft	5.114	30
2-1/2*	2.875	2.468	1.00	5.80 lbs/ft	7.875	30
3*	3.500	3.068	1.00	7.58 lbs/ft	10.783	19
4*	4.500	4.026	1.00	10.80 lbs/ft	16.316	19

*Only available in Casa Grande, AZ
**Corrosion Resistance Ratio per latest UL Directory Listing

PIPE PREPARATION

For proper operation, all pipe surfaces should be cleaned prior to installation. In order to provide a leak-tight seat for the gasket, pipe surfaces should be free from indentations and projections from the end of the pipe to the groove. All loose paint, scale, dirt, chips, grease, and rust must be removed prior to installation. Failure to take these important steps may result in improper coupling assembly, causing leakage. Also, check the manufacturer's instructions for the specific fitting used.

BULL MOOSE TUBE COMPANY

For Additional Information Contact (800) 325-4467
Or From Canada Call: (800) 882-4666

www.bullmoosetube.com
sales@bullmoosetube.com

1819 Clarkson Road
Chesterfield, MO 63017

Gerald, MO | Kent, WA | Casa Grande, AZ | Masury, OH

Eddy Flow - Hydraulic Tables

The Cost Effective Replacement For Schedule 10

COMPARISON

NPS (in)	O.D. (in)	INSIDE DIAMETER			C.R.R.*	
		EDDY FLOW (in)	SCHEDULE 10 (in)	SCHEDULE 40(in)	EDDY FLOW	SCHEDULE40
1 1/4	1.660	1.530	1.442	1.380	1.98	1.00
1 1/2	1.900	1.728	1.682	1.610	3.44	1.00
2	2.375	2.203	2.157	2.067	2.78	1.00
2 1/2	2.875	2.705	2.635	2.469	1.66	1.00
3	3.500	3.34	3.20	3.068	1.00	1.00
4	4.500	4.310	4.260	4.026	1.00	1.00

* *Corrosion Resistance Ratio*

BENEFITS

- *Dual Certified to ASTM A135 and A795.*
- *FM Approved for roll grooved, and welded, and plain-end application in wet systems.*
- *UL Listed (for U.S. and Canada) for joining by welding or by listed rubber gasketed fittings for use in wet, dry, preaction, and deluge type sprinkler systems.*
- *UL Listed (for US and Canada) and FM Approved for use with Victaulic® FIT® Fittings in plain end applications.*
- *Lightweight - saves shipping costs, and offers easier handling.*
- *Can be used with roll grooved couplings or welded outlets for pressures up to 300 psi.*
- *Floor stock available in various lengths produced in Casa Grande (AZ), Gerald (MO), and Masury (OH). Also can be ordered in custom lengths.*
- *Can be used for wet and dry** systems.*

** *Eddy Flow can be hot dipped galvanized to meet FM's requirement for dry systems.*

The following tables will help you determine the substantial hydraulic advantages of Eddy Flow over Schedule 10, and achieve cost savings through system downsizing. Any questions or comments should be addressed to Bull Moose Tube Technical Support Department at 888-227-5430, or via e-mail at techsupport@bullmoosetube.com. Please request our cutsheet for more information on Eddy Flow.

Friction loss calculations are based on the Hazen-Williams formula:

$$P = (4.52 \times Q^{1.85}) / (C^{1.85} \times d^{4.87}), \text{ Where}$$

P is the frictional resistance in pounds pressure per square inch per foot of pipe,
Q is the gallons per minute flowing,
d is the inside diameter of pipe in inches, and
C is the friction loss coefficient. C=100 (for dry systems), C= 120 (for wet systems).
I.D.'s used for the calculations are given in parenthesis.

BULL MOOSE TUBE COMPANY
A CAPARO company
1819 Clarkson Road
Chesterfield, MO 63017
(800) 325-4467
FAX: (636) 537-2645
www.bullmoosetube.com
e-mail:sales@bullmoosetube.com

For additional information, contact your salesperson today at (800) 325-4467 or (636) 537-2600 in the USA, or from Canada call (800) 882-4666

Eddythread 40 - Hydraulic Tables

A Lightweight Schedule 40 Replacement Pipe That Has a Corrosion Resistance Ratio of 1.0

EDDYTHREAD 40 SPECIFICATIONS

NOMINAL PIPE SIZE (in)	WEIGHT (lbs/ft)	I.D. (in)	BUNDLE SIZE
1	1.461	1.083	70
1 1/4	2.070	1.418	51
1 1/2	2.547	1.654	44
2	3.308	2.123	30

CORROSION RESISTANCE RATIOS

NOMINAL PIPE SIZE (in)	SCHEDULE 40	EDDYTHREAD 40 *
1	1.00	1.00
1 1/4	1.00	1.00
1 1/2	1.00	1.00
2	1.00	1.00

** Eddythread 40 can be hot dipped galvanized to meet FM's requirement for dry systems*

The following tables will help you determine the substantial hydraulic advantages of Eddythread 40 over Schedule 40, and achieve cost savings through system downsizing. Any questions or comments should be addressed to Bull Moose Tube Technical Support Department at 888-227-5430, or via e-mail at techsupport@bullmoosetube.com. Please request our cutsheet for more information on Eddythread 40.

Friction loss calculations are based on the Hazen-Williams formula

$P = (4.52 \times Q^{1.85}) / (C^{1.85} \times d^{4.87})$, Where

P is the frictional resistance in pounds pressure per square inch per foot of pipe,
Q is the gallons per minute flowing,
d is the inside diameter of pipe in inches, and
C is the friction loss coefficient. C=100 (for dry systems), C= 120 (for wet systems).
I.D.'s used for the calculations are given in parenthesis.

BULL MOOSE TUBE COMPANY
A CAPARO company

1819 Clarkson Road
Chesterfield, MO 63017
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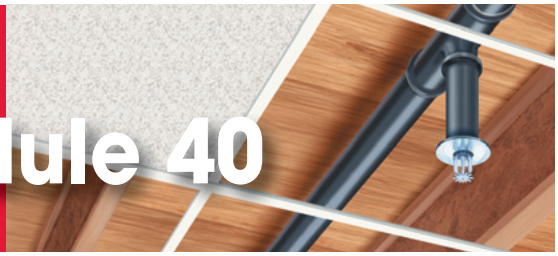
FAX: (636) 537-2645
www.bullmoosetube.com
e-mail:sales@bullmoosetube.com

For additional information, contact your salesperson today at (800) 325-4467 or (636) 537-2600 in the USA, or from Canada call (800) 882-4666

STEEL FIRE SPRINKLER PIPE

Schedule 10 and Schedule 40

SUBMITTAL DATA SHEET



High Quality, High Performance, Long-Lasting

Wheatland's Schedule 10 and Schedule 40 steel fire sprinkler pipe have set the industry's standards for years. Both products are subjected to the toughest possible testing to assure the highest possible quality and reliable, long-lasting performance.

Each is coated with Wheatland's proprietary mill coating to assure a clean, corrosion-resistant surface that outperforms and outlasts standard lacquer coatings. The coating also allows the pipe to be easily painted, without special preparation.

You can order Schedule 10 or Schedule 40 in black, or with hot-dip galvanizing, to meet FM requirements for dry systems to meet the zinc coating specifications of ASTM A795 or A53.

Both Schedule 10 and 40 are UL, C-UL and FM listed and meet NFPA 13 standards. We coat all of our black products up to 6" with our patented MIC Shield™ coating, which helps protect against the onset of microbial corrosion (MIC). Our MIC Shield was the first factory applied coating to be approved by FM as compatible with hybrid sprinkler systems that include CPVC plastic pipe in mixed use occupancies. MIC Shield is also chemically compatible with Flow Guard Gold®, Blaze Master® and Corizan® CPVC.

Why Wheatland?

- Experience: We've manufactured fire sprinkler pipe since 1931
- We produce the most complete line of products in the industry
- We offer a number of proprietary products and unique benefits
- We provide a complete line of coatings:
  - in-house, hot dip galvanizing
  - black sprinkler pipe
  - MIC shield™, the first FM global approved factory applied, anti-microbial coating for use with CPVC plastic pipe systems
  - proprietary mill coatings that provide corrosion resistant properties
  - proprietary mill coatings that extend shelf life

Schedule 10 and 40 Meet or Exceed These Standards

- UL, C-UL and FM Listed
- FM Approved
- ASTM A135, , Type E, Grade A (Schedule 10)
- ASTM A795, Type E, Grade A (Schedule 40)

Green: The steel used to produce Wheatland's sprinkler pipe contains recycled steel and is virtually totally recyclable.

Seismic/Sway Bracing: Wheatland sprinkler pipe data tables are available for determining the forces for piping used as a sway brace component or in Seismic applications.

Technical Data Chart

PRODUCT NPS	NOM I.D	WT/FT	WT/FT H_2O FILLED	PCS/ LIFT	WT/LIFT 21'	WT/LIFT 24'	WT/LIFT 25'
Schedule 10							
1 1/4"	1.442	1.807	2.514	61	2,315	2,645	2,756
1 1/2"	1.682	2.087	3.049	61	2,673	3,055	3,183
2"	2.157	2.640	4.222	37	2,051	2,344	2,442
2 1/2"	2.635	3.534	5.895	30	2,226	2,544	2,651
3"	3.260	4.336	7.949	19	1,730	1,977	2,060
4"	4.260	5.619	11.789	19	2,242	2,562	2,669
5"	5.295	7.780	17.309	13	2,124	2,427	2,529
6"	6.357	9.298	23.038	10	1,953	2,232	2,325
8"	8.625	219.1	8.249	209.5	0.188	4.78	16.96
Schedule 40							
1"	1.049	1.681	2.055	70	2,471	2,824	2,942
1 1/4"	1.380	2.275	2.922	51	2,437	2,785	2,901
1 1/2"	1.610	2.720	3.602	44	2,513	2,872	2,992
2"	2.067	3.656	5.109	30	2,303	2,632	2,742

Project: _____ Contractor: _____ Date: _____

Engineer: _____ Specification Reference: _____ System Type: _____

Locations: _____ Comments: _____

Wheatland Tube
JMC STEEL GROUP
700 South Dock Street, Sharon, PA 16146
Ph: 800.257.8182 • Fax: 724.346.7260
info@wheatland.com • www.wheatland.com

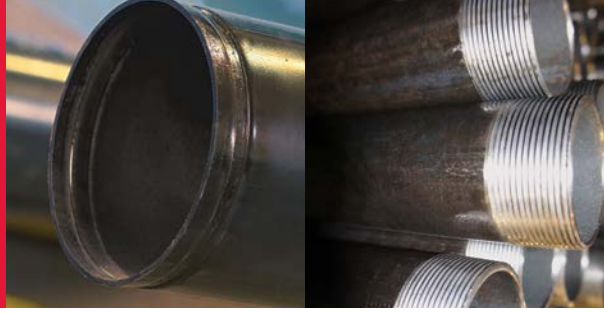
Made in U.S.A.

Rev. 6/16/11

Fire Sprinkler Pipe

Mega-Flow and Mega-Thread

Submittal Data Sheet



FM Approved and Fully Listed Sprinkler Pipe
Wheatland's Mega-Flow steel fire sprinkler pipe is FM Approved for roll-grooved, plain-end and welded joints for wet systems; and UL, C-UL and FM Listed for use with roll-grooved, plain-end couplings and welded joints for wet, dry preaction and deluge systems. Mega-Thread is FM Approved for use in wet systems and is UL, C-UL and FM Listed for wet, dry and preaction sprinkler systems.

Approvals and Specifications
Both products meet or exceed these standards:

- ASTM A795, Type E, Grade A
- NFPA 13 and NFPA 14
- Mega-Thread is approved for standard hanger spacing

Manufacturing Protocols
Mega-Flow and Mega-Thread are subjected to the toughest possible testing protocols to ensure the highest quality and long-lasting performance.

Finishes and Coatings
Mega-Flow black steel fire sprinkler pipe receives a proprietary mill coating to ensure a clean, corrosion-resistant surface that outlasts standard lacquer coatings. This coating allows the pipe to be easily painted without special preparation. Mega-Thread is hot-dip galvanized to meet FM requirements for dry systems and is safer to weld than many zinc-coated, light-wall threadable products.

Product Marking
Each length of Wheatland fire sprinkler pipe is continuously stenciled to show the manufacturer, type of pipe, grade, size and length. Barcoding is acceptable as a supplementary identification method.

MEGA-FLOW SPECIFICATIONS

NPS	NOM OD	NOM ID			UL CRR*		MEGA-FLOW	
		Mega-Flow	Schedule 10	Schedule 40	Mega-Flow	Schedule 40	Nominal wt./ft.	Pcs./Lift
1¼	1.660	1.530	1.442	1.380	1.80	1.00	1.108	61
1½	1.900	1.740	1.682	1.610	2.64	1.00	1.556	61
2	2.375	2.215	2.157	2.067	2.14	1.00	1.961	37
2½	2.875	2.707	2.635	2.469	1.43	1.00	2.504	30
3	3.500	3.316	3.260	3.068	1.34	1.00	3.349	19
4	4.500	4.316	4.260	4.026	1.00	1.00	4.331	19
6	6.625	6.395	6.357	6.065	.75	1.00	8.000	10

** Calculated using Standard UL CRR formula, UL Fire Protection Directory, Category VIZY.*
** The CRR is a ratio value used to measure the ability of a pipe to withstand corrosion. Threaded Schedule 40 steel pipe is used as the benchmark (value of 1.0).*

MEGA-THREAD SPECIFICATIONS

NPS	NOM OD	NOM ID		UL CRR*			MEGA-THREAD	
		Mega-Thread	Schedule 40	Mega-Thread	Schedule 40	L.W.T. Pipe	Nominal wt./ft.	Pcs./Lift
1	1.315	1.087	1.049	1.00	1.00	.61	1.462	70
1¼	1.660	1.416	1.380	1.00	1.00	.39	1.989	51
1½	1.900	1.650	1.610	1.00	1.00	.31	2.370	44
2	2.375	2.117	2.067	1.00	1.00	.25	3.094	30

** Calculated using Standard UL CRR formula, UL Fire Protection Directory, Category VIZY.*
** The CRR is a ratio value used to measure the ability of a pipe to withstand corrosion. Threaded Schedule 40 steel pipe is used as the benchmark (value of 1.0).*

SUBMITTAL INFORMATION

PROJECT: _____ CONTRACTOR: _____ DATE: _____

ENGINEER: _____ SPECIFICATION REFERENCE: _____ SYSTEM TYPE: _____

LOCATIONS: _____ COMMENTS: _____

☐ MEGA-FLOW — BLACK ☐ MEGA-THREAD — HOT-DIP GALVANIZED

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P 800.257.8182 | **F** 724.346.7260 | info@wheatland.com | wheatland.com

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JMC STEEL GROUP

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Model BFV-N Butterfly Valve Grooved End 2-1/2 Inch - 10 Inch (DN65 - DN250)

General Description

The Model BFV-N Grooved End Butterfly Valves (Ref. Figure 1) are indicating type valves designed for use in fire protection systems where a visual indication is required as to whether the valve is open or closed. They are used, for example, as system, sectional, and pump water control valves. They have cut groove inlet and outlet connections that are suitable for use with grooved end pipe couplings that are listed and approved for fire protection systems.

For applications requiring supervision of the open position of the valve, the Gear Operators for the Model BFV-N Butterfly Valves are provided with two sets of factory installed internal switches each having SPDT contacts. The supervisory switches transfer their electrical contacts when there is movement from the valve's normal open position during the first two revolutions of the handwheel.

WARNINGS

The Model BFV-N Grooved End Butterfly Valves described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Technical Data

Model
BFV-N

Sizes: ANSI Inches / DN
2-1/2 (DN65), 3 (DN80),
4 (DN100), 5 (DN125),
6 (DN150), 8 (DN200), 10 (DN250)

Approvals
The 2-1/2 through 10 inch (DN65 - DN250) Model BFV-N Grooved End Butterfly Valves are UL and C-UL Listed and FM Approved.

In addition, the Model BFV-N Grooved End Butterfly Valves are listed by the California State Fire Marshall under Listing No. 7770-1670:100.

All laboratory listings and approvals are for indoor and outdoor use.

Maximum Working Pressure
- 2-1/2 - 8 Inch (DN65 - DN200): 300 psi (20,7) bar
- 10 Inch (DN250): 175 psi (12,0 bar)

Materials of Construction:

Body
Ductile iron conforming to ASTM A-395

Body Coating
Polyamide

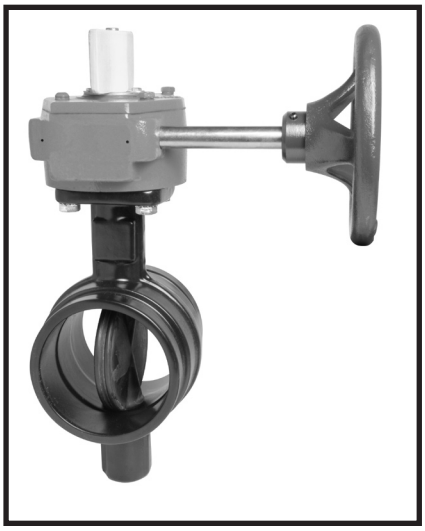
Disc
Ductile iron conforming to ASTM A-395

Disc Seal
Grade EPDM "E" encapsulated rubber conforming to ASTM D-2000

Upper & Lower Stem
Type 416 Stainless Steel conforming to ASTM 582

Lower Plug
PVC

Operator
Gear operator with iron housing



Friction Loss
The approximate friction loss, based on the Hazen Williams formula and expressed in equivalent length of pipe with C= 120, is as follows. The data is based on friction loss information collected at a typical flow rate of 15 feet per second.
- 6.9 feet of 2-1/2 inch Sch. 40 pipe for the 2-1/2 inch valve.
- 8.7 feet of 3 inch Sch. 40 pipe for the 3 inch valve.
- 4.5 feet of 4 inch Sch. 40 pipe for the 4 inch valve.
- 6.6 feet of 5 inch Sch. 40 pipe for the 5 inch valve.
- 11.1 feet of 6 inch Sch. 40 pipe for the 6 inch valve.
- 10.2 feet of 8 inch Sch. 30 pipe for the 8 inch valve.
- 12.1 feet of 10 inch Sch. 30 pipe for the 10 inch valve.

Nominal Valve Sizes	Pipe O.D.	Nominal Installation Dimensions in Inches and (mm)								Weight
		A	B	C	D	E	F	G	H	lbs. (kg)
2-1/2" DN65	2.88 (73,0)	3.85 (98,0)	11.71 (297,4)	3.25 (83,0)	5.43 (137,9)	6.00 (152,4)	7.81 (198,4)	2.50 (63,5)	0	22 (10,0)
3" DN80	3.50 (88,9)	3.85 (98,0)	12.25 (311,1)	3.54 (90,0)	5.68 (144,2)	6.00 (152,4)	7.81 (198,4)	2.50 (63,5)	0	23 (10,4)
4" DN100	4.50 (114,3)	4.56 (116,0)	13.95 (354,3)	4.35 (110,0)	6.58 (167,1)	6.00 (152,4)	7.81 (198,4)	2.50 (63,5)	0	28 (12,7)
5" DN125	5.56 (141,3)	5.86 (149,0)	14.93 (379,2)	4.84 (123,0)	7.07 (179,6)	6.00 (152,4)	7.81 (198,4)	2.50 (63,5)	0	31 (14,1)
6" DN150	6.63 (168,3)	5.86 (149,0)	17.31 (439,7)	5.93 (151,0)	8.35 (212,0)	6.00 (152,4)	7.81 (198,4)	2.50 (63,5)	0.67 (17,0)	41 (18,6)
8" DN200	8.63 (219,1)	5.26 (134,0)	19.20 (487,7)	6.87 (174,0)	9.29 (236,0)	6.00 (152,4)	7.81 (198,4)	2.50 (63,5)	5.86 (148,8)	53 (24,1)
10" DN250	10.75 (273,1)	6.29 (160,0)	25.11 (637,8)	9.17 (233,0)	11.50 (292,1)	9.00 (228,6)	7.68 (195,1)	3.00 (76,2)	7.41 (188,2)	88 (40,0)

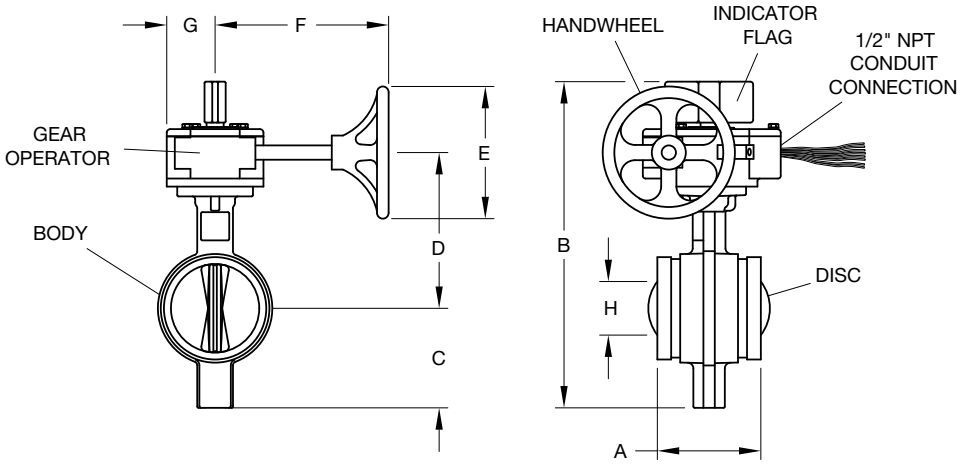


FIGURE 1
MODEL BFV-N GROOVED END BUTTERFLY VALVE
– NOMINAL DIMENSIONS –

Installation

The Model BFV-N Grooved End Butterfly Valves may be installed with flow in either direction and can be positioned either horizontally or vertically.

The grooved end pipe couplings used with the Model BFV-N must be listed or approved for fire protection service and installed in accordance with the manufacturers instructions.

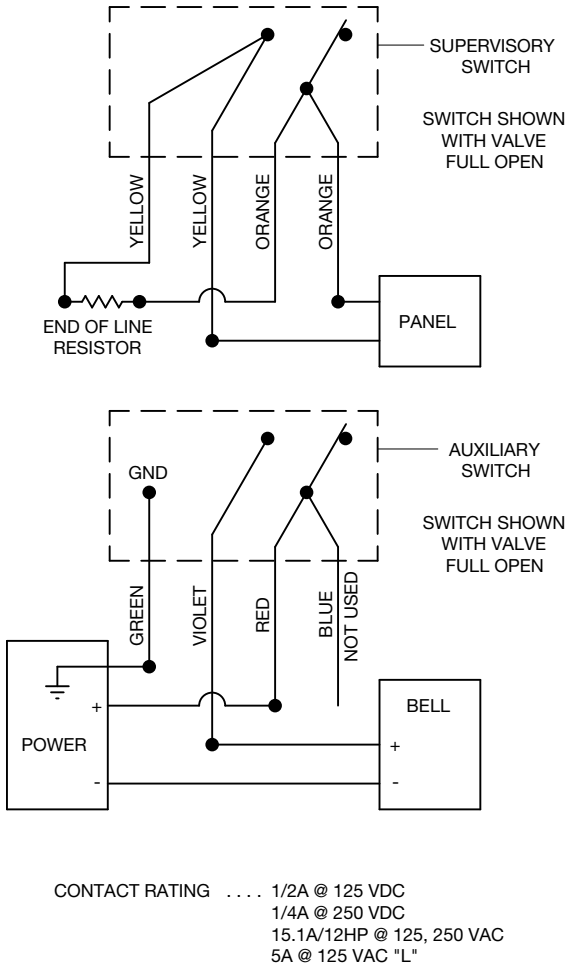
The Model BFV-N Butterfly Valve may be installed with any schedule of pressure class of pipe or tubing that is listed or approved for fire protection.

As applicable, refer to Figure 2 for the internal switch wiring diagram.

Conduit and electrical connections are to be made in accordance with the authority having jurisdiction and/or the National Electrical Code. With reference to Figure 2, the "supervisory switch" is intended for connection to the supervisory circuit of a fire alarm control panel in accordance with NFPA 72. The "auxiliary switch" is intended for the unsupervised connection to auxiliary equipment in accordance with NFPA 70, National Electric Code.

NOTE

For outdoor applications with internal supervisory switches, it is recommended that wiring connections be made at a temperature above 15°F (-9°C), in order to insure sufficient flexibility of the wire lead insulation.



CONTACT RATING . . . . 1/2A @ 125 VDC
1/4A @ 250 VDC
15.1A/12HP @ 125, 250 VAC
5A @ 125 VAC "L"

FIGURE 2
MODEL BFV-N BUTTERFLY VALVE
– INTERNAL SWITCH WIRING DIAGRAM –

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in accordance with the applicable standards of the National Fire Protection Association (e.g., NFPA25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairment must be immediately corrected.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified inspection service.

NOTE

Before closing a fire protection system control valve for maintenance or inspection work on either the valve or fire protection system which it controls, permission to shut down the affected fire protection systems must be obtained from the proper authorities and all personnel who may be affected by this decision must be notified.

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

Grooved End Butterfly Valves:
Specify: (specify inch size) Model BFV-N Grooved End Butterfly Valve with internal supervisory switches, P/N (specify).

Valve Size	Valve Part Number
2-1/2	59-300-F-025N
3	59-300-F-030N
4	59-300-F-040N
5	59-300-F-050N
6	59-300-F-060N
8	59-300-F-080N
10	59-300-F-100N

KENNEDY VALVE

UL/FM Butterfly Valves

Designed for the Fire Protection Industry

Sizes: 2-1/2", 3", 4", 6", 8"
300 PSI Rated
Double Seal Design For Bubble Tight Shut Off
UL Listed and FM Approved
Outdoor Rated
Wetted Components NSF Approved
C.S.F.M. Approved
N.Y.C. Acceptable
Light Weight
Corrosion Resistant Fusion Bond Coating
Low Torque Operation, High Cycle Life
Easy to read Flag Type Position Indicator

MADE IN USA

10-Nov-09

Updated 04/07/10

KENNEDY VALVE

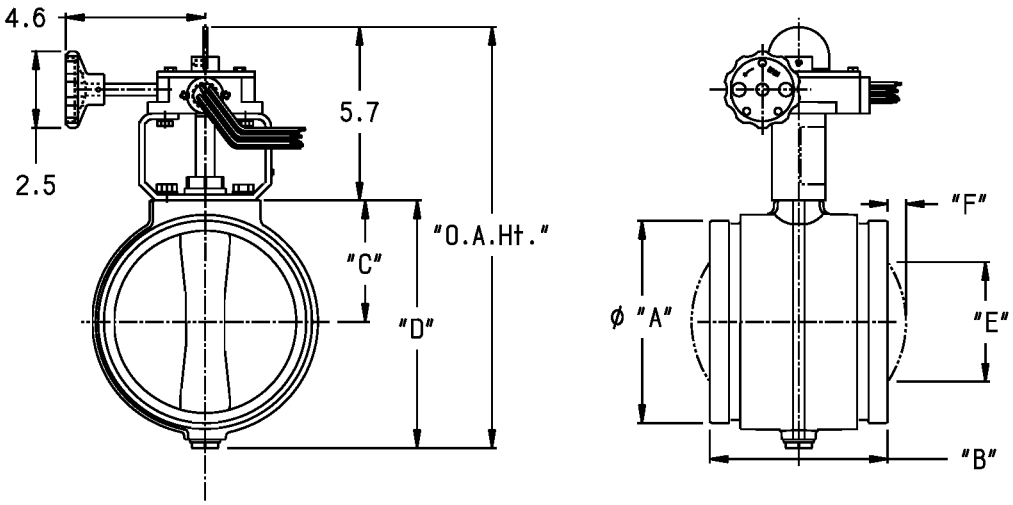
Division of McWane, Inc.
1021 East Water St., Elmira, NY 14901 (607) 734-2211

c UL us LISTED

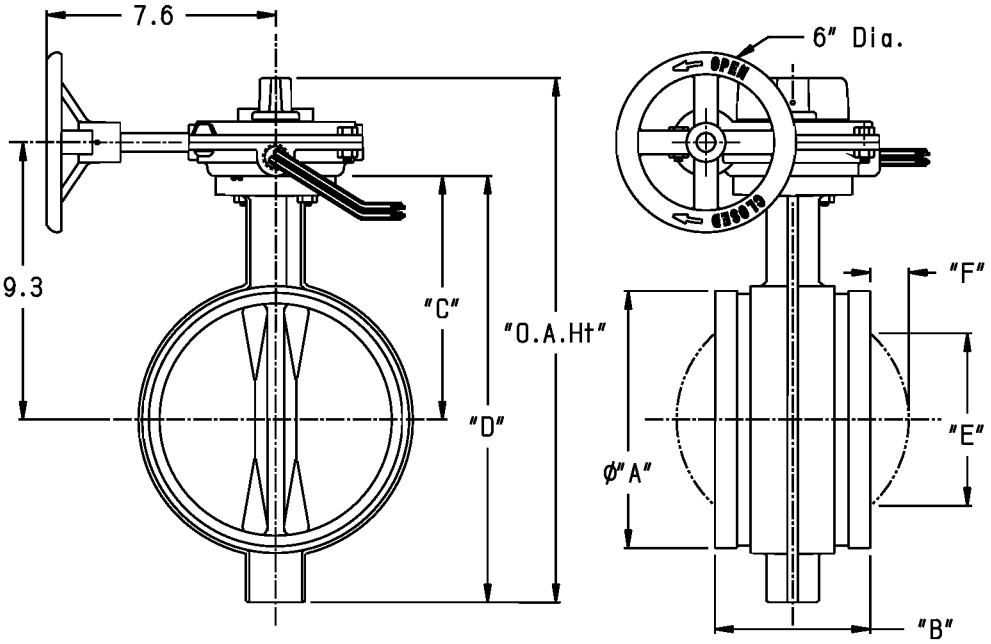
FM APPROVED

Grooved End Butterfly Valves 2-1/2" to 8"
Figure G300 & 01G 300 psi
with Supervisory Tamper Switch

Wetted Components NSF Approved 4"-8"



2-1/2" to 6"
G300
Outdoor Rated UL/FM



8" Only
01G
Outdoor Rated UL

1. UPPER AND LOWER SHAFTS: 416 SS
2. BODY COATING: EPOXY
3. DISC ENCAPSULATION MTL: SBR

	G300				01G
SIZE	2-1/2"	3"	4"	6"	8"
A	2.85	3.47	4.47	6.61	8.6
B	3.8	3.8	4.5	5.8	5.2
C	2.2	2.4	2.9	4.0	8.2
D	4.3	4.8	5.9	8.1	14.3
E	-	-	-	1.7	5.9
F	-	-	-	.1	1.3
O.A.Ht.	10.0	10.4	11.6	13.8	17.6
Wt.#	8.8	10.1	13.5	24.6	44

Note: "E" will be MINIMUM allowed pipe I.D.
Exercise care handling and during installation.

10-Nov-09

Updated 04/07/10

KENNEDY VALVE

Division of McWane, Inc.
1021 East Water St., Elmira, NY 14901 (607) 734-2211

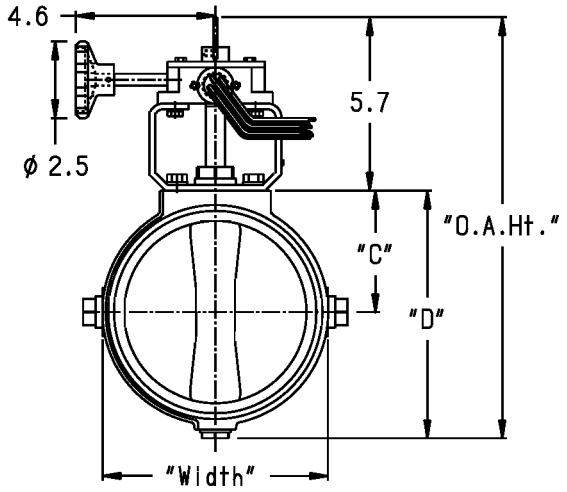
c UL us LISTED

FM APPROVED

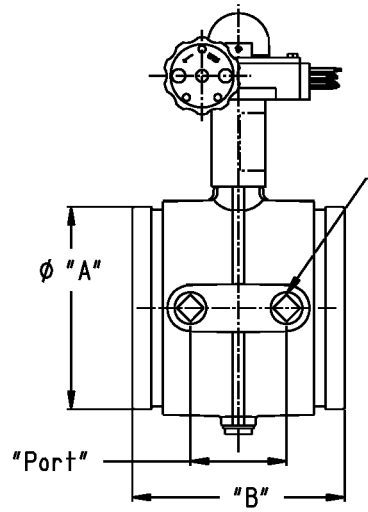
Grooved End Butterfly Valves 2-1/2" to 8"

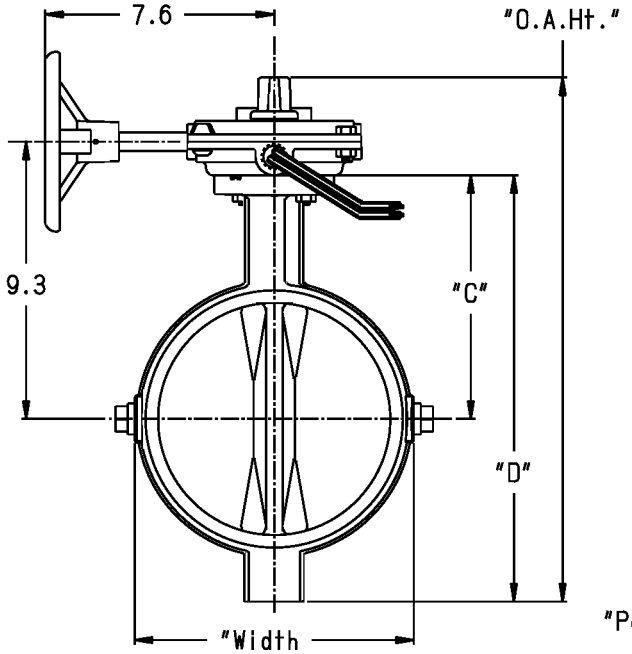
Figure G300E & 02G 300 psi with Supervisory Tamper Switch

- ☐ Extended Length Valves Equipped with Four 3/4"NPT Ports
- ☐ Wetted Components NSF Approved 4"-8"
- ☐ 4" to 8" sizes have been Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California

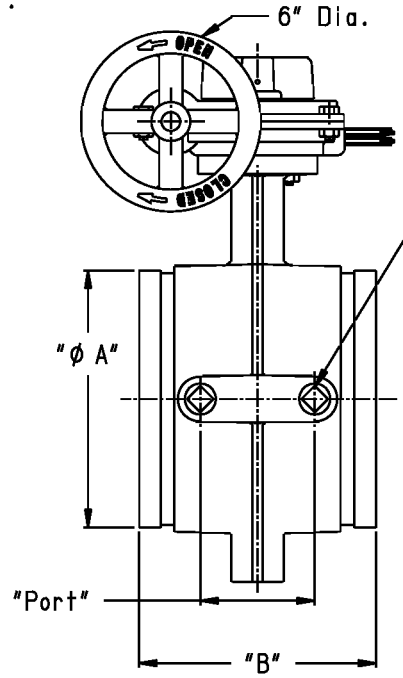


2-1/2" to 6"
G300E
Outdoor Rated UL/FM





8" Only
02G
Outdoor Rated UL



1. UPPER AND LOWER SHAFTS: 416 SS
2. BODY COATING: EPOXY
3. DISC ENCAPSULATION MTL: SBR

	G300E				02G
SIZE	2-1/2"	3"	4"	6"	8"
A	2.85	3.47	4.47	6.61	8.6
B	6.0	6.3	6.6	6.9	7.9
C	2.2	2.4	2.9	4.0	8.2
D	4.3	4.8	5.9	8.1	14.3
Width	3.7	4.2	5.2	7.4	9.3
Port	2.3	2.6	2.8	3.1	2.3
O.A.Ht.	10.0	10.4	11.6	13.8	17.6
Wt.#	12.5	14.5	18	28	55

Note: Disc does not protrude past the "B" dimension of the body on any size in the open position. Exercise care handling and during installation.

10-Nov-09

Updated 04/07/10

KENNEDY VALVE

Division of McWane, Inc.
1021 East Water St., Elmira, NY 14901 (607) 734-2211

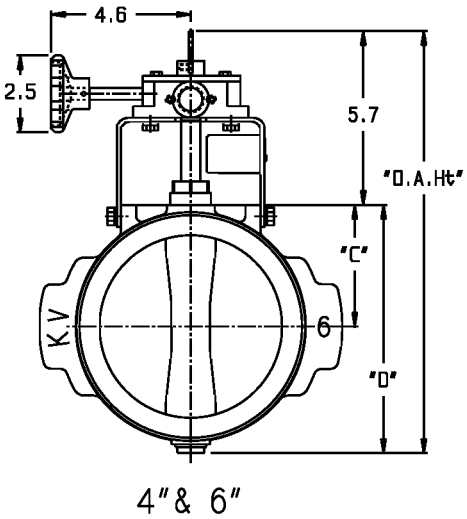
c UL us LISTED

FM APPROVED

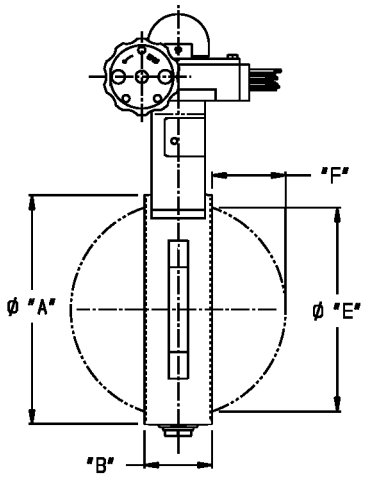
Wafer Butterfly Valves 2-1/2" to 8"

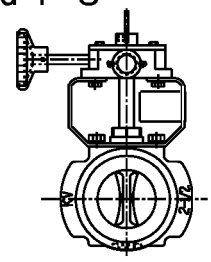
Figure W300,W300I, & 01G 300 psi with Supervisory Tamper Switch

Wetted Components NSF Approved 4"- 8"

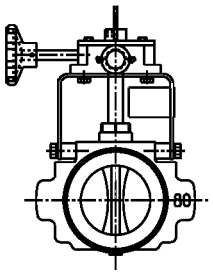


4"& 6"





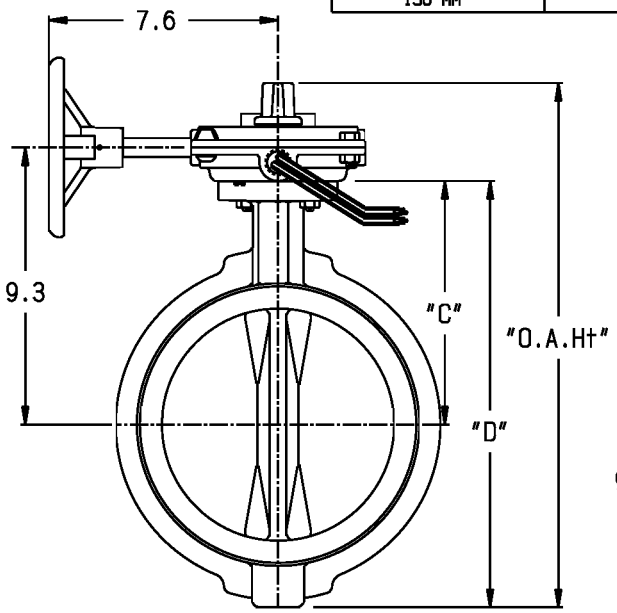
2-1/2" & 3"

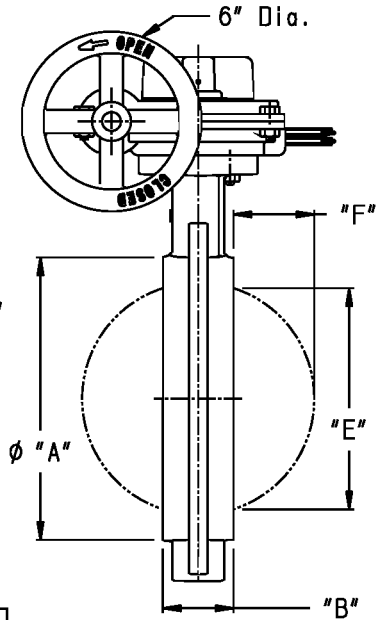


W300I - ISO PN16 FLANGE
3"/80mm & 4"/100mm ONLY

2-1/2" to 6"
W300 & W300I
Outdoor Rated UL/FM

VALVE SELECTION FOR ISO PN 16 FLANGE	
FLANGE SIZE	KV MODEL
65 MM	2-1/2" W300
80 MM	3" W300I
100 MM	4" W300I
150 MM	6" W300





8" Only
01W
Outdoor Rated UL

WAFER BOLTING					
SIZE	2-1/2"	3"	4"	6"	8"
Number of Studs	4	4	8	8	8
Stud size (inch)	5/8	5/8	5/8	3/4	3/4
Stud Length Min. (inch)	5.5	5.5	6.5	7	7.5
Recommended Min.Torque (Ft-Lbs)	30	30	30	40	50

1. UPPER AND LOWER SHAFTS: 416 SS
2. BODY COATING: EPOXY
3. DISC ENCAPSULATION MTL: SBR

	W300, W300I				01W
SIZE	2-1/2"	3"	4"	6"	8"
A	4.2	4.4	5.3	7.5	9.5
B	1.8	1.8	2.0	2.2	2.4
C	2.2	2.4	2.9	4.0	8.2
D	4.3	4.8	5.9	8.1	14.3
E	1.7	2.4	3.3	5.6	7.5
F	.4	.6	.9	1.9	2.7
O.A.Ht.	10.0	10.4	11.6	13.8	17.6
Wt.#	10.5	11.1	13.8	20.5	44

Dimensions B, D, and E are referenced in Installation Instructions.
"E" is MINIMUM allowed pipe I.D.
Exercise care handling and during installation

10-Nov-09

Updated 04/07/10

BUTTERFLY VALVE - G300/G300E/W300/W300I/01G/01W/02G
SUPPLEMENTARY INSTALLATION INSTRUCTIONS

Information shown here is intended to supplement, not replace, instructions that is shipped with each valve.

Dimensional information regarding minimum pipe I.D. and disc protrusion are shown on dimensional page for particular valve.

Exercise care handling and during assembly.

Grooved Body

For use with grooved end in steel pipe (IPS)

See valve dimensional information for min. pipe I.D (dimension E)

Valves shall be installed by person(s) certified to install grooved end fittings in a fire protection system by authority having jurisdiction.

1) Place gasket over pipe or fitting to which valve will be joined.
2) Position valve against mating pipe/fitting.
3) Slide gasket into position on valve and adjacent pipe/fitting and install coupling according to coupling manufacturer's instructions.

Wafer Body

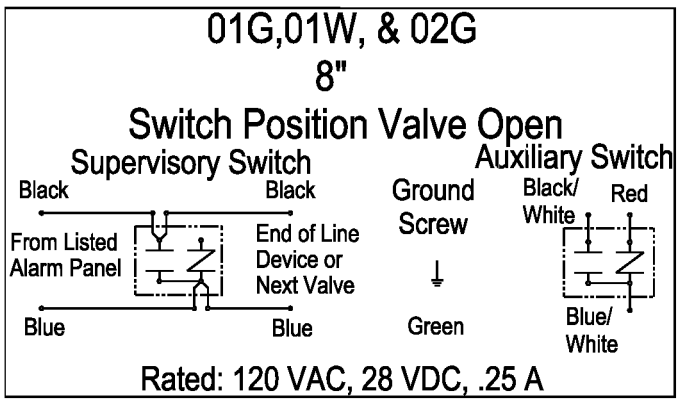
For installation between two ANSI B16.1, 125 lb. flanges

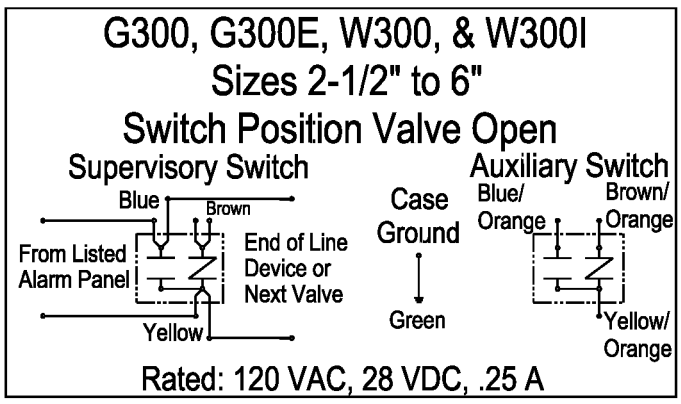
See valve dimensional information for min. pipe I.D. (dimension E)

1) Two flanged mating pieces should be placed at a distance apart that is slighty more than the thickness of the body (dim.B on wafer table)
2) A minimum of 2 studs shall be placed through adjacent flange holes so that the lower trunnion of the valve can fit between them. Normally this is the bottom 2 holes if the valve will be vertical with open/closed indicator on top.
3) Place the valve between the flanges-take care not to disturb the body gaskets.
4) Place remaining studs around the valve and tighten using an alternating pattern until desired torque is reached.

Switch Wiring

1) Valve has internal switches that operate from the OPEN position.
2) One switch has dual leads that is for connection to the SUPERVISORY circuit of an alarm panel. The other switch has single leads and is intended to be connected to AUXILIARY equipment.
3) Unused leads can be tucked into junction box (not provided)
4) Always comply with national codes, local codes, and NPFA 13, 71, and 72.





10-Nov-09

Kennedy Valve

A DIVISION OF McWANE, INC.

www.kennedyvalve.com

2009

1021 E. Water Street • Elmira, New York 14901
P.O. Box 981
PHONE: (607) 734-2211 • FAX: 1-800-952-4771

PUB_K8IV_909

Updated 04/07/10

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VALVE

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Specifications

Fire Valves

ALL FIRE VALVES MANUFACTURED FOR AND BY SIGMA PIPING PRODUCTS CONFORM TO, COMPLY WITH, AND ARE MANUFACTURED TO THE FOLLOWING STANDARDS:

ASTM A 126 Class B	Standard spec for Cupola Cast Iron
ASTM A 536-	Standard spec for Ductile Iron Gr. 65-45-12
ASTM A 307B-	Standard spec for Carbon Steel Forgings
ASME B 62 C83600-	Standard spec for Bronze Casting
ASME B 16 C36000-	Standard spec for Stainless Steel Forgings

Brass Ball Valves

ALL FIRE VALVES MANUFACTURED FOR AND BY SIGMA PIPING PRODUCTS CONFORM TO, COMPLY WITH, AND ARE MANUFACTURED TO THE FOLLOWING STANDARDS:

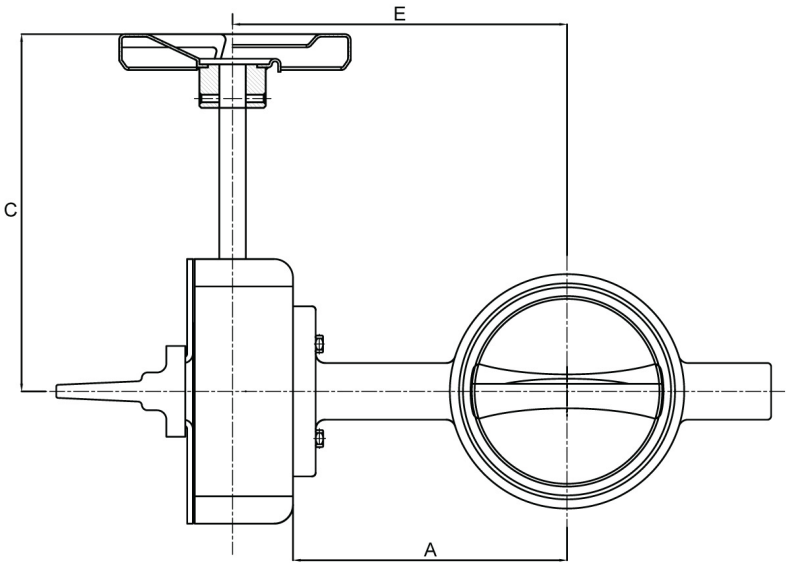
ASTM A 307B-	Standard spec for Carbon Steel Forgings
ASME B 16 C36000-	Standard spec for Brass Casting
ASTM C37700-	Standard spec for Brass Forgings
ASTM C85700-	Standard spec for Brass Forgings

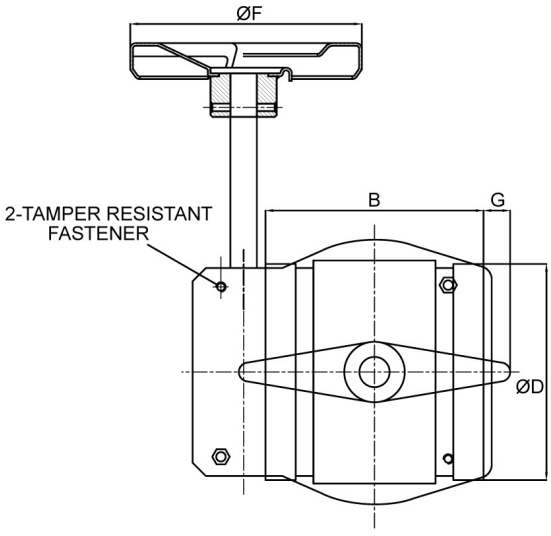
GROOVED UL/FM BUTTERFLY VALVE

- Size: 2 ½ through 8
- Working Pressure: 300psi (21.5 bars)
- Tampered Switch for Indoor and Outdoor use
- Max. Test Pressure: 600psi (43.0 Bars)
- Working Temperature: 250F (120°C)

Description

GROOVED END BUTTERFLY VALVE





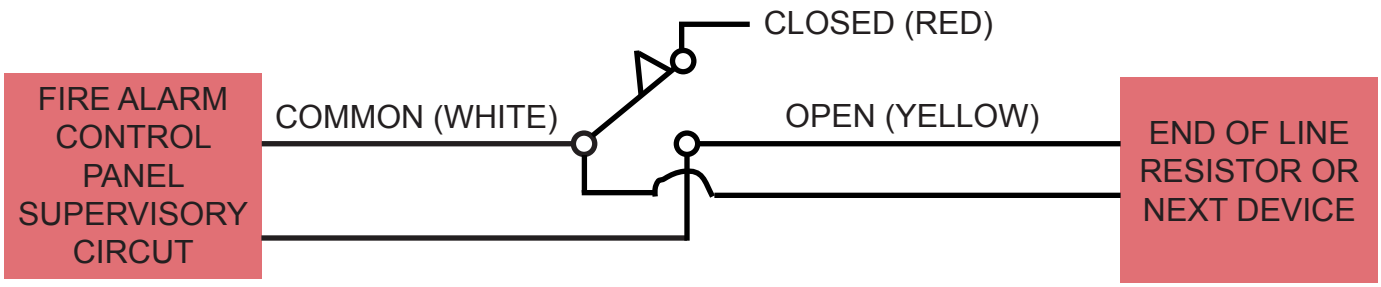
COMPONENT	MATERIAL
Body	Ductile Iron, EPDM Encapsulated
Disc	Al-Bronze, Ni-Cr Plated
Stem	Syainless Steel, Hardened & Tempered
Housing	Ductile Iron (ASTM A-536)
Handwheel	Ductile Iron (ASTM A-536)

VALVE SIZE	ITEM CODE	A	B	C	D	E	F	G
2 ½”	UFP025	4.13”	3.80”	6.61”	2.88”	5.39”	4.92”	
3”	UFP026	4.41”	3.80”	6.61”	3.50”	5.67”	4.92”	
4”	UFP027	5.71”	4.54”	6.61”	4.50”	6.97”	4.92”	
6”	UFP028	7.05”	5.21”	8.19”	6.63”	8.31”	8.86”	.27”
8”	UFP029	8.03”	5.80”	8.19”	8.62”	9.29”	8.86”	.95”

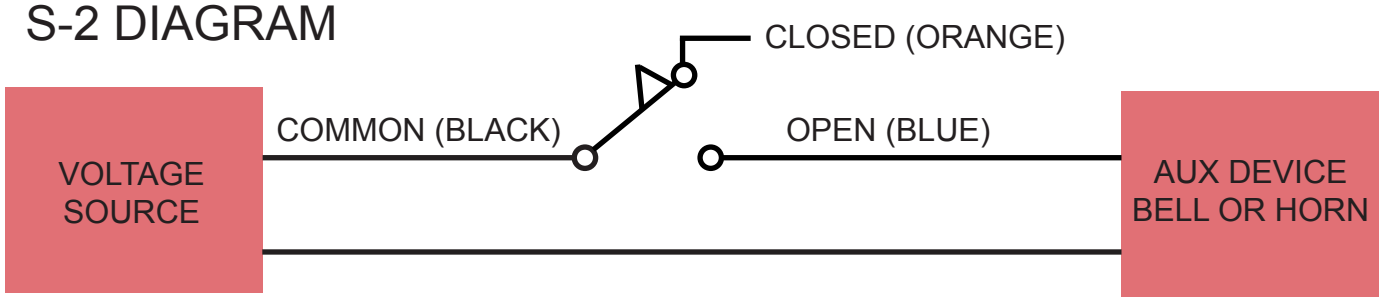
Fire Valve

BUTTERFLY VALVE WIRING DIAGRAM

S-1 DIAGRAM



S-2 DIAGRAM



RATED: 5A-1/6HP-125/250V AC 0.5A-125V DC 0.25A-250V DC

Switch #1 S1

For connection to the supervisory circut of a UL Listed alarm control panel.

- Normal Closed (2) Red
- Normal Open (2) Yellow
- Common (2) White

Switch #2

Auxiliary switch which may be connected per authority having jurisdiction to auxiliary device.

- Normal Closed (1) Orange
- Normal Open (1) Blue
- Common (1) Black

Fire Valve

BRASS BALL VALVE

- 600 PSI Rating
- 1/2” through 2” Stock Avaliable
- UL Listed and FM Approved

Description

BRASS BALL VALVE

600LB. WOG

UL APPROVAL:

- Trim and Drain (300 PSI)
- Compressed Gas Shut-off Valve (600 PSI)
- Flammable Liquid Shut-off Valve (600 PSI)
- Gas Shut-off Valve (600 PSI)
- LP-Gas Shut-off Valve (600 PSI)
- Manual Valves (600 PSI)

FM APPROVAL:

- 600 PSI Rating

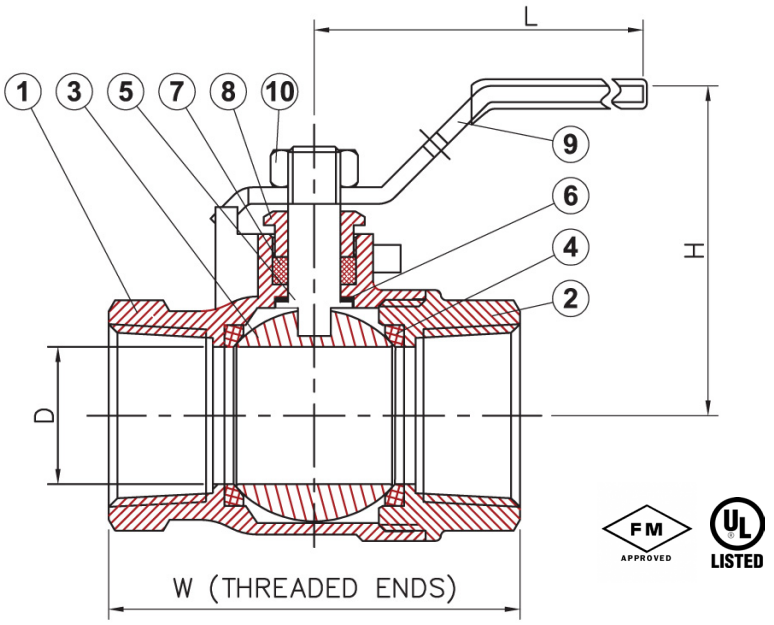
NSF 61 APPROVAL:

- Obtained NSF61 Section 8 certificate through IAPMO
- Compliant to Prop65 standard and the testing result is below 5ppb.

CSA APPROVAL:

- Pilot Adjustable National Standard of Canada. Class 3371-08 Requirement Can1-91
- Gas Lever Non Lubricated Shut-off Valve. Class 3371-10 Requirement CGA-3.16
- Manual Gas Valves on Piping Systems. Class 3371-12. Requirement CGA CR-9102
- General Gas Valve US Standard. Class 3371-88. Requirement ANSI Z 21.15

NO.	COMPONENT	MATERIAL
1	Body	Forged Brass ASTM C3770
2	End Cap	Forged Brass ASTM C3770
3	Ball	Brass ASTM C85700 or ASTM C37700
4	Seat	PTFE
5	Stem	Brass ASTM B16
6	Thrust Washer	PTFE
7	Packing	PTFE
8	Gland	Brass ASTM B16
9	Handle	Carbon Steel Plated
10	Nut	Carbon Steel Plated



VALVE SIZE	ITEM CODE	D	W	H	L
1/2”	UFP019	0.5”	2.12”	1.45”	3.23”
3/4”	UFP020	0.75”	2.41”	1.78”	3.94”
1”	UFP021	0.98”	2.96”	2.29”	4.72”
1 1/4”	UFP022	1.22”	3.28”	2.44”	4.72”
1 1/2”	UFP023	1.50”	3.67”	3.00”	7.09”
2”	UFP024	1.97”	4.21”	3.30”	7.09”

COMPANY OVERVIEW

Our mission is to supply the highest quality engineered products to customers in the Commercial & Residential Plumbing, Gas, Electrical, Industrial, Fire Protection and HVAC industries. SIGMA uses its relationships with the most qualified and reliable suppliers in the world along with the comprehensive knowledge of supply chain management to provide the finest quality services available.

Our experience, technical expertise and network of global resources enables us to offer the advantages of using a “one-stop shop”. This provides engineering, quality assurance, product scheduling, importing, warehousing and delivery.

SIGMA Piping Products is a division of SIGMA Corporation. SIGMA Corporation has been developing products for the North American Water and Wastewater industry for over 25 years. Today we are one of the world’s largest suppliers of specialty water products within the American Waterworks Association (AWWA) range. At SIGMA we are proud to offer the highest quality ductile iron waterworks fittings, pipe restraint products and municipal casting products available in the market. We operate a network of warehouses and distribution offices that provide us with a national reach.

The company has grown rapidly through an increased focus on geographic expansion and by broadening our extensive product line. We have recently complemented our portfolio by acquiring a number of new product lines to service the Fire Protection, Plumbing and Industrial industries. These strategic acquisitions broaden our business and play to the strengths of the SIGMA team.

SHIPPING LOCATIONS

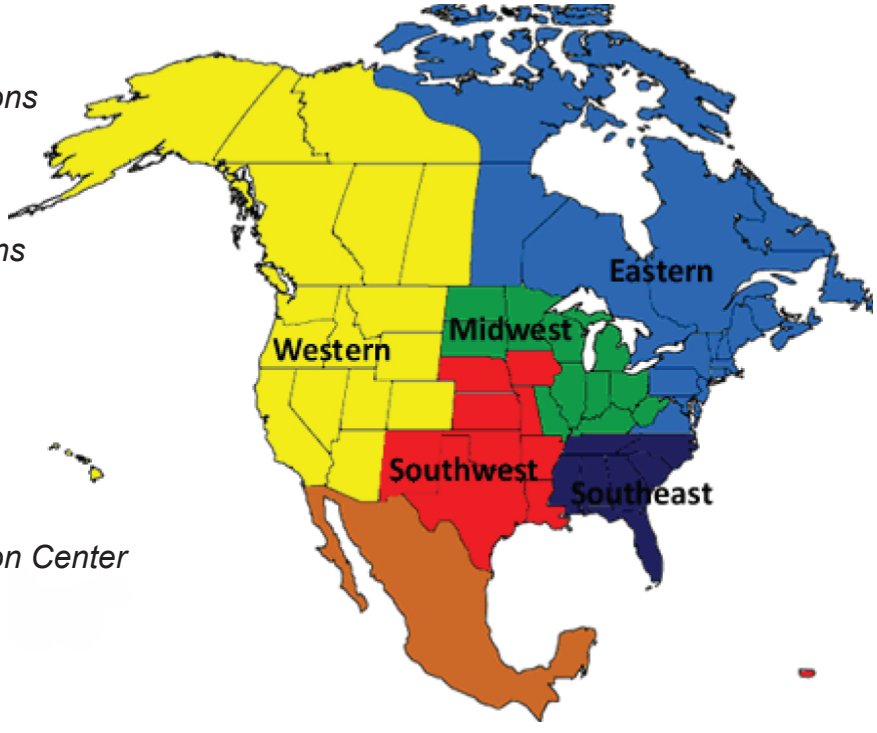
Southwest & Midwest Regions
5000 Askins
Houston, TX 77093

Southeast & Eastern Regions
1500 Hwy 22 W
Alexander City, AL 35010

Western Region
316 Bonview Ave.
Ontario, CA 91761

Pacific Northwest Distribution Center
902 W. Main Street
Auburn, WA 98001

(800) 999-0109



Quality Management

SIGMA believes that quality does not cost, it pays. Our team commitment to quality is to maximize the combined value of our service to each of our customers by supplying all of our products to the highest requirements and standards of customer satisfaction. We strive to ensure that our products are delivered free of defects at a competitive price with the utmost attention to all aspects of product development, production and supply chain management.

The SIGMA Quality Plan is unique to the industry. We have designed our Quality Plan to assure reliability to the highest level. The plan starts with each casting having a casting ID that we call a heat number that enables us to identify the location, production facility, date and batch of production.

SIGMA uses detailed Quality Inspection Procedures (QIP) for each product category to guide our overseas production facilities. These QIPs incorporate the relevant standards and go much further in detail as to what SIGMA expects the factory to do. The aggregation of the QIPs, the Quality Plan and Statistical Process Control together assures SIGMA and our customers of the high reliability of our products.

Associations/Approvals/Listings/Memberships

----- American Fire Sprinkler Association

----- National Fire Sprinkler Association

----- Factory Mutual Approves

----- MEA Listed (New York City Approval)

----- American Society for Testing Materials

----- American National Standards Institute

----- American Society Of Mechanical Engineers

----- Underwriters' Labratories

----- Underwriters' Labratories of Canada & US

----- Underwriters' Labratories of Canada

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Tyco Fire Products Model CV-1F Check Valve

General Description

The Tyco® Model CV-1F Check Valve is a compact and rugged swing-type unit that allows water flow in one direction and prevents flow in the opposite direction. A resilient elastomer seal facing on the spring loaded clapper ensures a leak tight seal and non-sticking operation. The Model CV-1F Check Valves are designed to minimize water hammer caused by flow reversal.

The CV-1F is furnished with grooved ends and can be installed using Grinnell® Grooved Couplings or Grinnell Figure 71 Flange Adapters. The Model CV-1F Check Valves have been designed with a removable cover for ease of field maintenance. Valves installed horizontally or inclined (flow up or down) are to be positioned with the cover facing up. Valves installed vertically may be positioned with flow up or down.

A Maintenance Check Valve Kit (TFP1555) is available to allow the maintenance procedure of backflushing through the fire department connection without removing the Model CV-1F Check Valve from the pipe line.

The Model CV-1F Check Valves are a redesignation for the Central Figure 590F and Grinnell Figure 590F.

NOTICE

The Model CV-1F Check Valve described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of this device.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or manufacturer should be contacted with any questions.

Technical Data

Sizes- Inches / DN
2 to 12 / DN50 to DN300

Maximum Working Pressure
300 psi (20,7 bar)

Approvals
UL, FM, and C-UL.

Protective Coating
Valve assembly
- Non-lead paint

Installation

The Model CV-1F Check Valves are to be installed in accordance with the following instructions:

Step 1. The arrow cast on the Body must point in the direction of the flow.

Step 2. Valves installed vertically may be positioned with the flow up or down.

Step 3. Valves installed horizontally or inclined (flow up or down) are to be positioned with the Cover facing up.

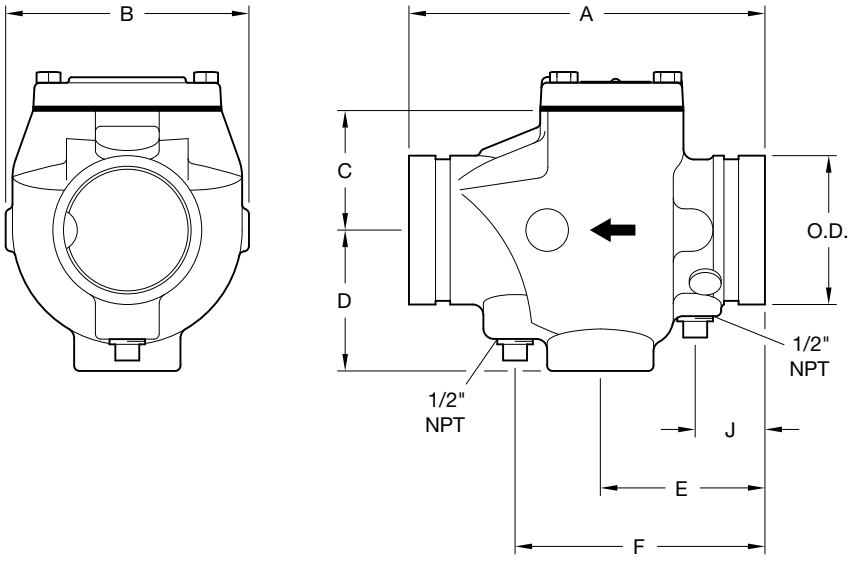
Step 4. Grooved end pipe couplings used with the CV-1F must be installed in accordance with manufacturer's instructions.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairments must be immediately corrected.

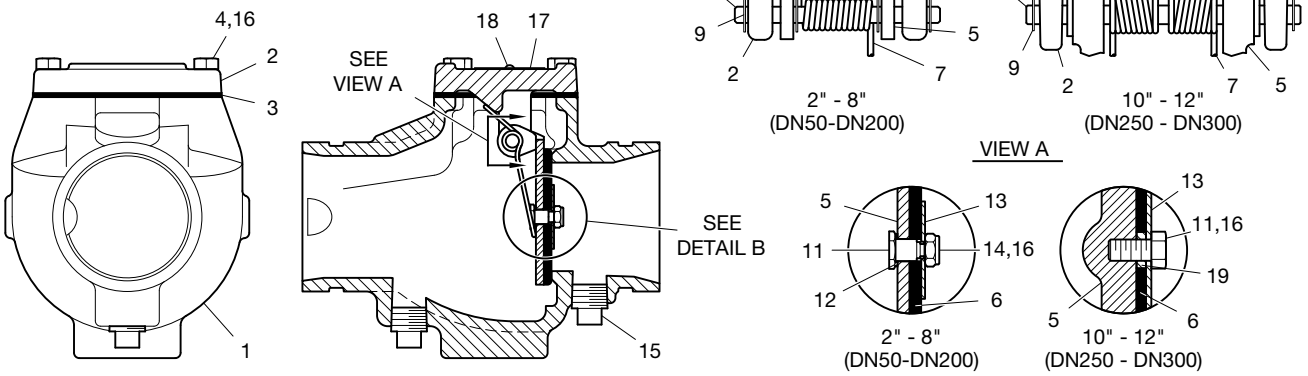
Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

After placing a fire protection system in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.



Nominal Pipe Size		Nominal Dimensions- Inches (mm)							Cover Bolt Torq. Lbs.-ft. (Nm)	Approx. Weight Lbs. (kg)
ANSI Inches DN	O.D. Inches (mm)	A	B	C	D	E	F	J		
2 DN50	2.375 (60,3)	6.75 (171,5)	4.38 (111,3)	2.55 (64,8)	2.57 (65,3)	3.25 (82,3)	4.75 (120,7)	1.62 (41,5)	18 (25)	9.0 (4,5)
2½ DN65	2.875 (73,0)	8.00 (203,2)	5.80 (147,3)	3.41 (86,6)	3.40 (86,4)	3.88 (98,6)	6.00 (152,4)	1.70 (43,2)	39 (54)	10.0 (4,5)
– DN65	– (76,1)	8.00 (203,2)	5.80 (147,3)	3.41 (86,6)	3.40 (86,4)	3.88 (98,6)	6.00 (152,4)	1.70 (43,2)	39 (54)	10.00 (4,5)
3 DN80	3.500 (88,9)	8.37 (212,6)	5.76 (146,3)	3.60 (91,4)	3.40 (86,4)	3.88 (98,6)	6.00 (152,4)	1.70 (43,2)	39 (54)	11.0 (5,0)
4 DN100	4.500 (114,3)	9.63 (244,6)	6.74 (171,2)	4.61 (117,1)	3.63 (92,2)	4.56 (115,1)	7.13 (181,1)	1.84 (46,7)	50 (69)	25.0 (11.3)
– DN125	– (139,7)	10.50 (266,7)	7.50 (190,5)	5.29 (134,4)	4.20 (106,7)	4.90 (124,5)	7.60 (193,0)	1.90 (48,3)	39 (54)	29.0 (13.2)
5 DN125	5.563 (141,3)	10.50 (266,7)	7.50 (190,5)	5.29 (134,4)	4.20 (106,7)	4.90 (124,5)	7.60 (193,0)	1.90 (48,3)	39 (54)	29.0 (13,2)
– DN150	– (165,1)	11.50 (292,1)	8.05 (204,5)	5.75 (146,1)	4.50 (114,3)	5.00 (127,0)	7.60 (193,0)	1.48 (37,6)	60 (82)	47.0 (21,3)
6 DN150	6.625 (168,3)	11.50 (292,1)	8.05 (204,5)	5.75 (146,1)	4.50 (114,3)	5.00 (127,0)	7.60 (193,0)	1.48 (37,6)	60 (82)	47.0 (21,3)
8 DN200	8.625 (219,1)	14.00 (355,6)	10.25 (260,4)	7.75 (196,9)	5.62 (142,7)	5.45 (138,4)	8.40 (213,4)	2.20 (58,9)	120 (164)	66.0 (29,9)
10 DN250	10.750 (273,1)	18.00 (457,2)	13.00 (330,2)	10.21 (259,3)	6.38 (162.1)	7.50 (190.5)	10.50 (266,7)	3.00 (76,2)	130 (178)	109.7 (49,4)
12 DN300	12.750 (323,9)	21.00 (533,4)	14.28 (362,7)	11.31 (287,2)	7.26 (184,4)	7.62 (193,5)	10.62 (269,7)	2.75 (69.9)	130 (178)	151.0 (68,0)

FIGURE 2
NOMINAL DIMENSIONS
MODEL CV-1F CHECK VALVES



Detail	Part	Material	Qty.
1	Body	Ductile Iron	1
2	Cover	Ductile Iron	1
3	Cover Gasket	Nitrile Rubber	1
4	Hex Cap Screw	Steel, Zinc Plated	AR
5	Clapper 2” - 8”	Stainless Steel	1
	Clapper 10” - 12”	Ductile Iron	

Detail	Part	Material	Qty.
6	Clapper Facing	EPDM Grade “E”	1
7	Spring	Stainless Steel	1
8	Hinge Shaft	Stainless Steel	1
9	Retaining Ring	Stainless Steel	AR
11	Retention Bolt	Stainless Steel	1
12	Seal Ring	Neoprene	1

Detail	Part	Material	Qty.
13	Retaining Disc	Stainless Steel	1
14	Locknut	Stainless Steel	1
15	Plug-½”-14 NPT	Cast Iron	2
16	Adhesive	Thread Sealer	AR
17	Nameplate	Aluminum	1
18	Rivet	Steel	2

FIGURE 2
MODEL CV-1F CHECK VALVES

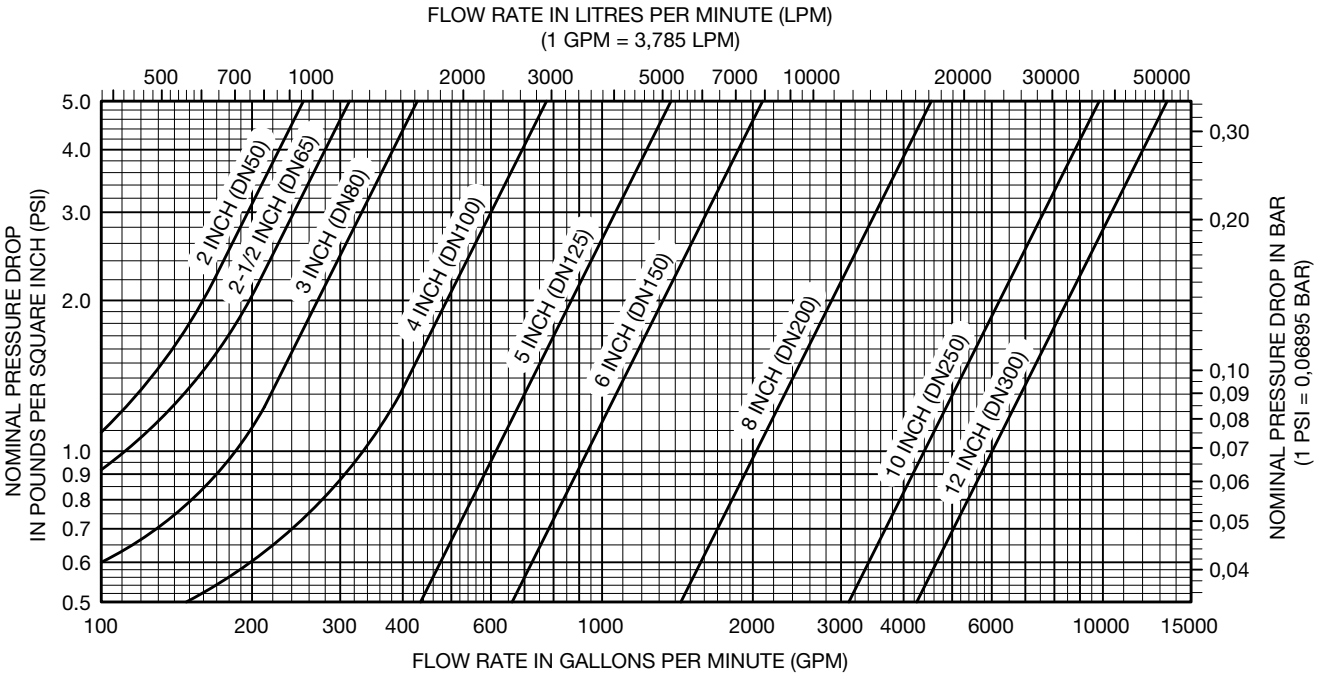


FIGURE 3
MODEL CV-1F PRESSURE LOSS DATA

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

The Model CV-1F Check Valves:
Specify: (specify size) Model CV-1F Check Valve, P/N (specify)

2" (DN50) Valves	59-590-0-020
2-1/2" (DN65) Valves	59-590-0-025
DN65 (76,1mm) Valves	59-590-0-076
3" (DN80) Valves	59-590-0-030
4" (DN100) Valves	59-590-0-040
DN125 (139,7) Valves	59-590-0-139
5" (DN125) Valves	59-590-0-050
DN150 (165,1) Valves	59-590-0-165
6" (DN150) Valves	59-590-0-060
8" (DN200) Valves	59-590-0-080
10" (DN250) Valves	59-590-0-100
12" (DN300) Valves	59-590-0-120

Replacement Valve Parts
Specify: (specify description) for use with (specify size) Model CV-1F Check Valve, P/N (specify)

2" (DN50) Valves	
Cover Gasket	976-705-01
Clapper Facing	976-709-01
2-1/2" (DN65) Valves	
Cover Gasket	975-618-01
Clapper Facing	975-621-01
3" (DN80) Valves	
Cover Gasket	975-618-01
Clapper Facing	975-491-01
4" (DN100) Valves	
Cover Gasket	975-120-01
Clapper Facing	975-003-01
5" (DN125) Valves	
Cover Gasket	975-120-01
Clapper Facing	975-219-01
6" (DN150) Valves	
Cover Gasket	975-218-01
Clapper Facing	975-006-01
8" (DN200) Valves	
Cover Gasket	975-479-01
Clapper Facing	975-463-01
10" (DN250) Valves	
Cover Gasket	976-000-01
Clapper Facing	975-977-01
12" (DN300) Valves	
Cover Gasket	976-472-01
Clapper Facing	976-474-01

TECHNICAL DATA

SWING CHECK VALVE
MODEL D-1 & G-1

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

The Viking Swing Check Valve is a general purpose rubber-faced check valve approved for use in fire protection systems. The Swing Check Valve is manufactured with a ductile iron body, brass seat, and a rubber-faced clapper assembly, hinged to a removable access cover for easy inspection and maintenance.

The valve may be installed vertically or horizontally with access cover facing up. For availability of flanged-flanged and grooved-grooved options, refer to Table 1. Tapped openings (with plugs) and gauge connections are provided on both the inlet and outlet chambers of the valve.

FEATURES

A. Ductile iron body for less weight and extra strength.
B. Rated to 300 psi (20.7 bar) water working pressure.
C. Rubber-faced clapper hinged to access cover for quick removal and easy servicing. All moving parts can be serviced without removing the valve from the installed position.
D. With the cover/clapper assembly removed, the clapper rubber replacement requires removal of only one screw.
E. Can be installed vertically or horizontally with access cover facing up.

2. LISTINGS AND APPROVALS

cULus Listed: Guide No. HMER
FM Approved: Single Check Valves
NYC Department of Buildings: MEA 89-92-E, Vol. XI

3. TECHNICAL DATA

Specifications:

Rated to 300 psi (20.7 bar) water working pressure.
Factory tested hydrostatically to 600 psi (41.4 bar).
Standard Flanged Connections: ANSI B16.42 Class 150 (mates with ANSI Class 125 and Class 150 flanges).
Standard Grooved Connections: ANSI/AWWA C606
Tapped Bosses: 2-1/2” (DN65), 3” (DN80) and 4” (DN100): Two 1/2” (15 mm) NPT
6” (DN150) and 8” (DN200): Two 3/4” (20 mm) NPT

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards: Refer to Figure 1.

Ordering Information: Refer to Table 1 for part numbers and shipping weight.

Table 1

Size Valve Nominal	Inlet Type	Outlet Type	Friction Loss*	Shipping Weight	Part No.
2-1/2" (DN65)	Groove	Groove	6 ft.(1.8 m)	16 lbs. (7 kg)	05497C
3" (DN80)	Goove	Groove	10 ft. (3.1 m)	20 lbs. (9 kg)	08536
4" (DN100)	Flange	Flange	13 ft. (4.0 m)	47 lbs. (21 kg)	08538
4" (DN100)	Groove	Groove	13 ft. (4.0 m)	27 lbs. (12 kg)	08539
6" (DN150)	Flange	Flange	20 ft. (6.0 m)	75 lbs. (34 kg)	08542
6" (DN150)	Groove	Groove	20 ft. (6.0 m)	51 lbs. (23 kg)	08543
8" (DN200)	Flange	Flange	23 ft. (7.0 m)	135 lbs. (61 kg)	08546
8" (DN200)	Groove	Groove	23 ft. (7.0 m)	106 lbs. (48 kg)	08547

*Expressed in equivalent length of Schedule 40 pipe based on Hazen & Williams formula: C = 120.

Systems with water working pressures above 175 psi (12 bar) may require extra-heavy pattern fittings. Viking Swing Check Valve flanges are Ductile Iron ANSI B16.42, Class 150, with a maximum water working pressure of 300 psi (20.7 bar). ANSI B16.42, Class 150 flanges are NOT compatible with ANSI Class 250 or Class 300 flanges. To mate the Viking Swing Check Valve with ANSI Class 250 or Class 300 flanges, use the grooved-inlet/grooved-outlet style installed with listed grooved/ flanged adapters of the appropriate pressure rating. For piping with grooved connections, the grooved-inlet/grooved-outlet style Swing Check Valve may be installed with listed grooved couplings of the appropriate pressure rating.

VIKING®

TECHNICAL DATA

SWING CHECK VALVE
MODEL D-1 & G-1

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

4. INSTALLATION

The Swing Check Valve must be installed in an area not subject to physical damage. When corrosive atmospheres and/or contaminated water supplies are present, it is the owner's responsibility to verify compatibility with the Swing Check Valve and associated equipment. Prior to installing the valve, thoroughly flush the water supply piping to verify that no foreign matter is present. The Swing Check Valve may be installed in the vertical position with direction of flow up, or in the horizontal position with the access cover up.

Systems with water working pressures above 175 psi (12 bar) may require extra-heavy pattern fittings. Viking Swing Check Valve flanges are Ductile Iron ANSI B16.42, Class 150, with a maximum water working pressure of 300 psi (20.7 bar). ANSI B16.42, Class 150 flanges are not compatible with ANSI Class 250 or Class 300 flanges. To mate the Viking Swing Check Valve with ANSI Class 250 or Class 300 flanges, use the grooved-inlet/grooved-outlet style installed with listed grooved/flanged adapters of the appropriate pressure rating. For piping with grooved connections, the grooved-inlet/grooved-outlet style Swing Check Valve may be installed with listed grooved couplings of the appropriate pressure rating.

5. OPERATION (Refer to Figure 1)

Flow through the Viking Swing Check Valve lifts the rubber-gasketed clapper (8, and 9) off the seat (12) to enter the sprinkler piping. When flow through the valve stops, the clapper (8) closes quickly. The rubber gasket (9) forms a tight seal against the brass water seat (12), trapping pressure above the clapper and preventing reverse flow from sprinkler piping.

Hydrostatic Test:

The Swing Check Valve is manufactured and listed for use at a maximum water working pressure of 300 psi (20.7 bar). The valve is factory tested at 600 psi (41.4 bar). Check Valves may be hydrostatically tested (in accordance with NFPA 13) at 350 psi (24.1 bar) and/or 50 psi (3.4 bar) above the normal water working pressure for limited periods of time (two hours) for the purpose of acceptance by the Authority Having Jurisdiction. If air testing is required, do not exceed 40 psi (2.8 bar) air pressure.

6. INSPECTIONS, TESTS AND MAINTENANCE

NOTICE: The owner is responsible for maintaining the fire-protection system and devices in proper operating condition.

The Viking Swing Check Valve must be kept free of foreign matter, freezing conditions (when used on wet systems), corrosive atmospheres, contaminated water supplies, and any condition that could impair its operation or damage the device.

It is imperative that the system be inspected and tested on a regular basis. The frequency of the inspections may vary due to contaminated water supplies, corrosive water supplies, and corrosive atmospheres. For minimum maintenance and inspection requirements, refer to NFPA 25. In addition, the Authority Having Jurisdiction may have additional maintenance, testing, and inspection requirements that must be followed.

WARNING: Any system maintenance which involves placing a control valve or detection system out of service may eliminate the fire-protection capabilities of that system. Prior to proceeding, notify all the Authority Having Jurisdiction. Consideration should be given to employment of a fire patrol in the affected areas.

6-A. Five-Year Internal Inspection

Internal inspection of Swing Check Valves is recommended every five years unless inspections and tests indicate more frequent inspections are required.

(Refer to Figure 1)

1. Notify the Authority Having Jurisdiction, remote station alarm monitors, and those in the area affected that the system will be taken out of service. Consideration should be given to employment of a fire patrol in the affected areas.
2. Close the water supply main control valve, placing the system out of service.
3. Open the main drain. If necessary, open the system test valve to vent and completely drain the system.
4. Use the appropriate wrench to loosen and remove the cover screws (14), and remove the cover/clapper assembly (2-11).
5. Inspect the water seat (12). Wipe away all contaminants, dirt, and mineral deposits. DO NOT use solvents or abrasives.
6. Inspect the cover/clapper assembly (2-11) and the cover gasket (13). Test the hinged clapper (8) for freedom of movement. Renew or replace damaged or worn parts as required.

CAUTION: Never apply any lubricant to seats, gaskets, or any internal operating parts of the valve. Petroleum-based grease or oil will damage rubber components and may prevent proper operation.

7. When Internal inspection of the Check Valve is complete, perform step 6 of paragraph 11. VALVE MAINTENANCE to reinstall the cover/clapper assembly (2-11).

VIKING®

TECHNICAL DATA

SWING CHECK VALVE MODEL D-1 & G-1

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Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

6-B. Valve Maintenance

(Refer to Figure 1)

1. Perform steps 1 through 5 of paragraph 6.A - FIVE-YEAR INTERNAL INSPECTION.
2. To remove clapper rubber (9):
   a. Use the appropriate wrenches to loosen and remove the button-head socket screw (11), hex nut (6), sealing washer (7), and rubber retainer (10).
   b. Remove the clapper rubber (9) for inspection. If the clapper rubber shows signs of wear, such as cracking, cuts, or excessively deep grooves where the rubber contacts the water seat, replace the rubber.
3. To re-install clapper rubber (9):
   a. Place the clapper rubber (9) over the center hub of the rubber retainer (10).
   b. Position the retainer (10) (with rubber in place) against the clapper (8) as shown in Figure 1.
   c. Replace and tighten the button-head socket screw (11), sealing washer (7), and hex nut (6). The sealing washer (7) and hex nut (6) must be located on the top side of the clapper as shown in Figure 1. Do not over-tighten.
4. To remove clapper (8), and/or hinge pin (4):
   a. Remove the hinge pin retaining rings (5) to free the hinge pin (4) for removal. After the hinge pin (4) is removed, the clapper (8) can be removed.
5. To re-install clapper (8), and/or hinge pin (4):
   a. Verify that the clapper rubber (9) is in good condition and that it is properly installed.
   b. Position the clapper (8) with the elongated hinge holes aligned between the holes of the hinge bracket welded inside the cover (2). The system (top) side of the clapper (8) must face the direction indicated by the flow arrow stamped inside the cover (2).
   c. Insert the hinge pin (4) through the holes at one end of the hinge assembly. Continue to push the hinge pin (4) through the holes at the remaining end of the hinge assembly.
   d. Re-install the hinge pin retaining rings (5).
6. To re-install cover/clapper assembly (2-11):
   a. Verify that cover gasket (13) is in position and in good condition.
   b. Slide the cover/clapper assembly (2-11) into the Swing Check Valve so that the clapper rubber (9) contacts the water seat (12).
   c. Replace the cover screws (14). Use the appropriate wrench to cross-tighten all screws to the torque value shown in Table 2 for the valve used. DO NOT over-tighten.

7. AVAILABILITY

The Viking Swing Check Valve is available through a network of domestic and international distributors. See the Viking Corp. Web site for closest distributor or contact The Viking Corporation.

8. GUARANTEES

For details of warranty, refer to Viking's current list price schedule or contact The Viking Corporation directly.

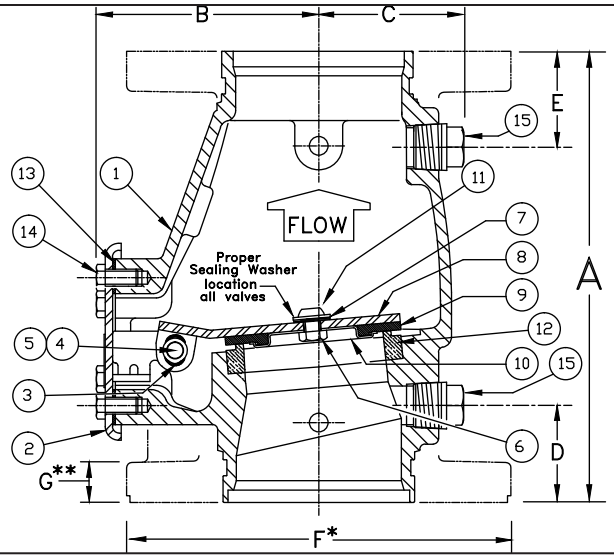
Table 2: Torque Values for Viking Swing Check Valve Cover Screws

Valve Size	Screw Size	Torque Values
2-1/2" (DN65)	3/8"-16 HHC	19 ft-lbs 2.63 kg-m
3" (DN80)	3/8"-16 HHC	19 ft-lbs 2.63 kg-m
4" (DN100)	3/8"-16 HHC	19 ft-lbs 2.63 kg-m
6" (DN150)	1/2"-13 HHC	45 ft-lbs 6.23 kg-m
8" (DN200)	5/8"-11 HHC	93 ft-lbs 12.9 kg-m

TECHNICAL DATA

SWING CHECK VALVE MODEL D-1 & G-1

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com



SIZE	A	B	C	D	E	F	G**
2-1/2" (65mm)	9" (228,6)	4-1/2" (114,3)	2-5/8" (66,7)	2" (50,8)	2" (50,8)	Flg-Flg Not Available	
3" (80mm)	10-1/8" (257)	4-13/16" (122,2)	2-11/16" (68,3)	2-9/32" (58.1)	2-9/32" (58.1)	Flg-Flg Not Available	
4" (100mm)	10-5/8" (269,9)	5-3/16" (131,8)	3-1/8" (79.4)	2-1/4" (57.2)	2-1/4" (57,2)	9" (228,6)	15/16" (23,81)
6" (150mm)	13-3/8" (340)	6-13/16" (173,3)	4-1/16" (103.2)	2-1/4" (57,2)	2-1/4" (57,2)	11" (279,4)	1" (25,4)
8" (200mm)	17" (431,8)	8-13/16" (223,4)	5" (127)	2-1/2" (63,4)	2-7/8" (73,0)	13-1/2" (342,9)	1-1/8" (28,58)

Dimensions shown in parentheses are millimeters.

** 4", 6", and 8" valves are manufactured with sculptured flanges. Dimension indicates thickness of flange at bolt holes.

Figure 1

ITEM NO.	PART NUMBER D-1 2-1/2" (DN65)	G-1 3" (DN80)	G-1 4" (DN100)	G-1 6" (DN150)	G-1 8" (DN200)	DESCRIPTION	MATERIAL	NO. REQ'D 2-1/2"	3"	4"	6"	8"
1	--	--	--	--	--	Body	Ductile Iron, ASTM A536 (65-45-12)	1	1	1	1	1
2	--	--	--	--	--	Cover Assembly, 300 PSI WWP	E-Coated HSLA Steel, A715 and Stainless Steel, UNS-S30400	1	1	1	1	1
3	07576	07576	07576	07576	None	Bushing	Lubricomp 189 Ryton	2	2	2	2	0
4	05355A	05355A	04900A	04991A	05334A	Clapper Hinge Pin	Stainless Steel, UNS-S30400	1	1	1	1	1
5	05445A	05445A	05445A	05445A	05369A	Hinge Pin Retaining Ring	Stainless Steel, UNS-S15700	2	2	2	2	2
6	01755A					Clapper Hex Jam Nut #10-24 UNC	Stainless Steel, UNS-S30400	1	0	0	0	0
		08159	08159			Clapper Hex Jam Nut 3/8"-24 UNF	Stainless Steel, UNS-S30400	0	1	1	0	0
				08144	08144	Clapper Hex Jam Nut ½"-20 UNC	Stainless Steel, UNS-S30400	0	0	0	1	1
7	06595A	08158	08158	08143	08143	Sealing Washer	EPDM and Stainless Steel	1	1	1	1	1
8	*	*	*	*	*	Clapper	Teflon® Coated HR Steel UNS-G10180	1	1	1	1	1
9	*	*	*	*	*	Clapper Rubber	EPDM, ASTM D2000	1	1	1	1	1
10	*	*	*	*	*	Clapper Rubber Retainer	Stainless Steel, UNS-S30400	1	1	1	1	1
11	06595A					H.H.C. Screw #10-24 UNC x 1/2" (12.7 mm) lg.	Stainless Steel, UNS-S30400	1	0	0	0	0
		10194	10194			Screw, Button Head, Socket, 3/8" - 24 UNF x 1/2"	Stainless Steel, UNS-S30400	0	1	1	0	0
				10308		Screw, Button Head, Socket, 1/2" - 20 UNF x 3/4" (19.1 mm) lg.	Stainless Steel, UNS-S30400	0	0	0	1	1
					10686	Screw, Button Head, Socket, 1/2" - 20 UNF x 7/8"	Stainless Steel, UNS-S30400	0	0	0	0	1
12	--	--	--	--	--	Seat	Brass, UNS-C84400	1	1	1	1	1
13	05354B	05354B	04649B	04992B	05339C	Cover Gasket	EPDM, ASTM D2000	1	1	1	1	1
14	01517A	01517A	01517A			H.H.C. Screw 3/8"-16 UNC x 3/4" (19,1 mm) lg.	Steel, Zinc Plated	4	4	6	0	0
				04993A		H.H.C. Screw ½"-13 UNC x 7/8" (22.2 mm) lg.	Steel, Zinc Plated	0	0	0	6	0
					01922A	H.H.C. Screw 5/8"-11 UNC x 1-1/4" (31.8 mm) lg.	Steel, Zinc Plated	0	0	0	0	6
15	--	--	--			1/2" (15 mm) NPT Pipe Plug	Steel	2	2	2	0	0
				--	--	3/4" (20 mm) NPT Pipe Plug	Steel	0	0	0	2	2

-- Indicates replacement part is not available

* Indicates replacement part only available in a Sub-Assembly listed below.

Sub-Assemblies

3, 6-11	05499B	08518	08519	08520	08521	Clapper Assembly
9, 10	--	14864	14865	14866	--	Replacement Clapper Rubber Kit*

*Clapper rubbers are different on 3", 4", & 6" G-1 valve than original manufacture. If clapper rubber requires replacement, order replacement rubber kit.

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Model 513 (13) Riser Manifold 1-1/2 thru 6 Inch (DN40 thru DN150) For NFPA 13 Sprinkler Systems

General Description

The Figure 513 (13) Riser Manifolds described in this technical data sheet provide the necessary waterflow alarm, pressure gauge, alarm test orifice, drain, and sight glass equipment in a single assembly for use in NFPA 13 sprinkler systems as follows:

NFPA 13*

- 1-1/2 Inch (DN40)
  Male Thread x Female Thread
- 1-1/2 thru 6 Inch (DN40 thru DN150)
  Groove x Groove

*Although the Riser Manifold described in this data sheet is intended for NFPA 13 sprinkler systems, it may be used for NFPA 13D or 13R residential sprinkler systems, where a test orifice of 5.6K (80K) is acceptable.

The variety of sizes and grooved end connections allow cost effective and easy transition to check valves, control valves, and system piping. The Riser Manifolds may be installed in either the horizontal (flow switch on top) or vertical (flow going up) for both single sprinkler rises and floor control in high rises.

WARNING

The Riser Manifolds described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Technical Data

Approvals
The Figure 513 (13) Riser Manifolds with a cover tamper switch for the waterflow alarm switch are UL Listed, ULC Listed, and FM Approved.

The Figure 513 (13) Riser Manifolds without a cover tamper switch for the waterflow alarm switch are UL Listed and FM Approved.

Maximum Working Pressure
175 psi (12,1 bar)

Test Orifice
5.6K (80K)

Assembly
The manifold body of the Figure 513 is ductile iron, whereas the manifold body of the Figure 13 is cast iron. The two assemblies are completely interchangeable in function, application, and end-to-end laying length.

Finish
Red painted.

Installation

The Riser Manifolds may be installed in either the horizontal (flow switch on top) or vertical (flow going up). The inlet of the Riser Manifold may be directly connected to a shut-off control valve.

NOTES

Where applicable pipe thread sealant is to be applied sparingly. Use of a non-hardening pipe thread sealant is recommended.

Never remove any piping component nor correct or modify any piping deficiencies without first depressurizing and draining the system.

Step 1. Install the manifold body with the flow arrow pointing in the downstream position using threaded connections and/or listed mechanical grooved connections, as applicable

Step 2. Connect the drain line, and then close the drain valve.

Step 3. Refer to Figure 3 for wiring guidance. All wiring must be performed in accordance with the Authority Having Jurisdiction and/or the National Electrical Code.

Step 4. Refer to Figure 4 for optional relief valve.

Step 5. Place the system in service by filling the system with water. When filling the system, partially open the control valve to slowly fill the system. *Filling the system slowly will help avoid damaging the waterflow alarm switch.*

After the system is fully pressurized, completely open the control valve.

Step 6. Secure all supply valves open.

NO.	DESCRIPTION	QTY.	P/N
1	1-1/2" Manifold Body,		
	Male x Female NPT	1	N/A
	Groove x Groove	1	N/A
2	Waterflow Alarm Switch:		
	VSR-SF with Paddle, UL/FM	1	971-096-00
	VSR-SF with Paddle and Cover Tamper Switch, ULC/FM	1	976-519-02
3	300 psi/2000 kPa Water Pressure Gauge	1	2341

NOTES:
1. Approximate weight, 11.2 lbs. (5,1 kg).
2. ULC Listed Manifolds are equipped with Cover Tamper Switches installed internal to the Waterflow Alarm Switches.
3. CH: Common Hardware

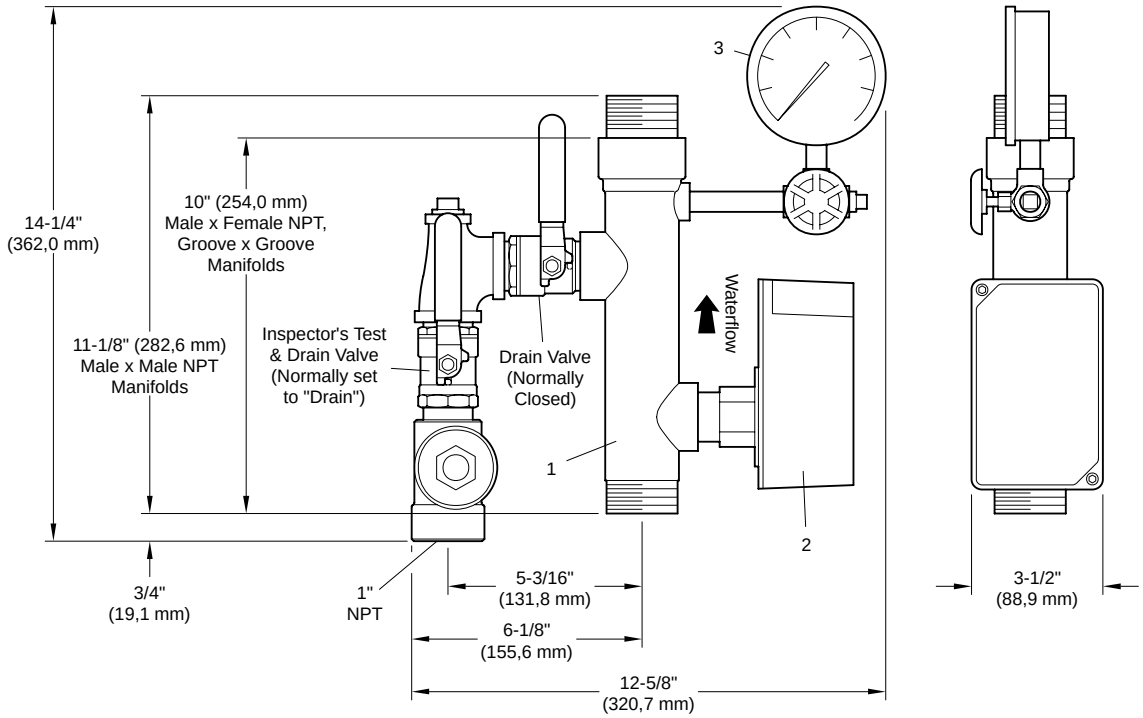


FIGURE 1
1-1/2 INCH (DN40) RISER MANIFOLD ASSEMBLY AND DIMENSIONS

2 INCH (DN50) MANIFOLD

NO.	DESCRIPTION	QTY.	P/N
1	2" Manifold Body, Groove x Groove	1	N/A
2	Waterflow Alarm Switch: VSC with Paddle, UL/FM	1	976-357-01
	VSC with Paddle and Cover Tamper Switch, ULC/FM	1	976-520-01
3	300 psi/2000 kPa Water Pressure Gauge	1	2341

4 INCH (DN100) MANIFOLD

NO.	DESCRIPTION	QTY.	P/N
1	4" Manifold Body, Groove x Groove	1	N/A
2	Waterflow Alarm Switch: VSC with Paddle, UL/FM	1	976-357-04
	VSC with Paddle and Cover Tamper Switch, ULC/FM	1	976-520-04
3	300 psi/2000 kPa Water Pressure Gauge	1	2341

6 INCH (DN150) MANIFOLD

NO.	DESCRIPTION	QTY.	P/N
1	6" Manifold Body, Groove x Groove	1	N/A
2	Waterflow Alarm Switch: VSC with Paddle, UL/FM	1	976-357-05
	VSC with Paddle and Cover Tamper Switch, ULC/FM	1	976-520-05
3	300 psi/2000 kPa Water Pressure Gauge	1	2341

2-1/2 INCH (DN65) MANIFOLD

NO.	DESCRIPTION	QTY.	P/N
1	2-1/2" Manifold Body, Groove x Groove	1	N/A
2	Waterflow Alarm Switch: VSC with Paddle, UL/FM	1	976-357-02
	VSC with Paddle and Cover Tamper Switch, ULC/FM	1	976-520-02
3	300 psi/2000 kPa Water Pressure Gauge	1	2341

Manifold Size	Nominal Installation Dimensions in Inches and (mm)							Drain Size	Weight
	A	B	C	D	E	F	G	H	lbs. (kg)
2 Inch (DN50)	16-3/4 (425,5)	13 (330,2)	9/16 (14,3)	5-3/8 (136,5)	6-3/8 (161,9)	13-1/16 (331,8)	3-1/2 (88,9)	1" NPT	13.5 (6,1)
2-1/2 Inch (DN65)	17-3/16 (436,6)	13 (330,2)	1 (25,4)	5-3/4 (146,1)	6-7/8 (174,6)	13-3/4 (349,3)	3-1/2 (88,9)	1-1/4" NPT	16.8 (7,6)
3 Inch (DN80)	17-3/16 (436,6)	13 (330,2)	1 (25,4)	6 (152,4)	7-1/8 (181,0)	14-1/4 (362,0)	3-1/2 (88,9)	1-1/4" NPT	18.7 (8,5)
4 Inch (DN100)	20-1/2 (520,7)	13 (330,2)	4-5/16 (109,5)	7-9/16 (192,1)	9-1/16 (230,2)	16-5/8 (422,3)	4-1/2 (114,3)	2" NPT	32.7 (14,8)
6 Inch (DN150)	20-1/2 (520,7)	13 (330,2)	4-5/16 (109,5)	8-1/2 (215,9)	10 (254,0)	18-1/2 (469,9)	6-5/8 (168,3)	2" NPT	41.6 (18,9)

3 INCH (DN80) MANIFOLD

NO.	DESCRIPTION	QTY.	P/N
1	3" Manifold Body, Groove x Groove	1	N/A
2	Waterflow Alarm Switch: VSC with Paddle, UL/FM	1	976-357-03
	VSC with Paddle and Cover Tamper Switch, ULC/FM	1	976-520-03
3	300 psi/2000 kPa Water Pressure Gauge	1	2341

NOTES:

1. ULC Listed Manifolds are equipped with Cover Tamper Switches installed internal to the Waterflow Alarm Switches.
2. CH: Common Hardware

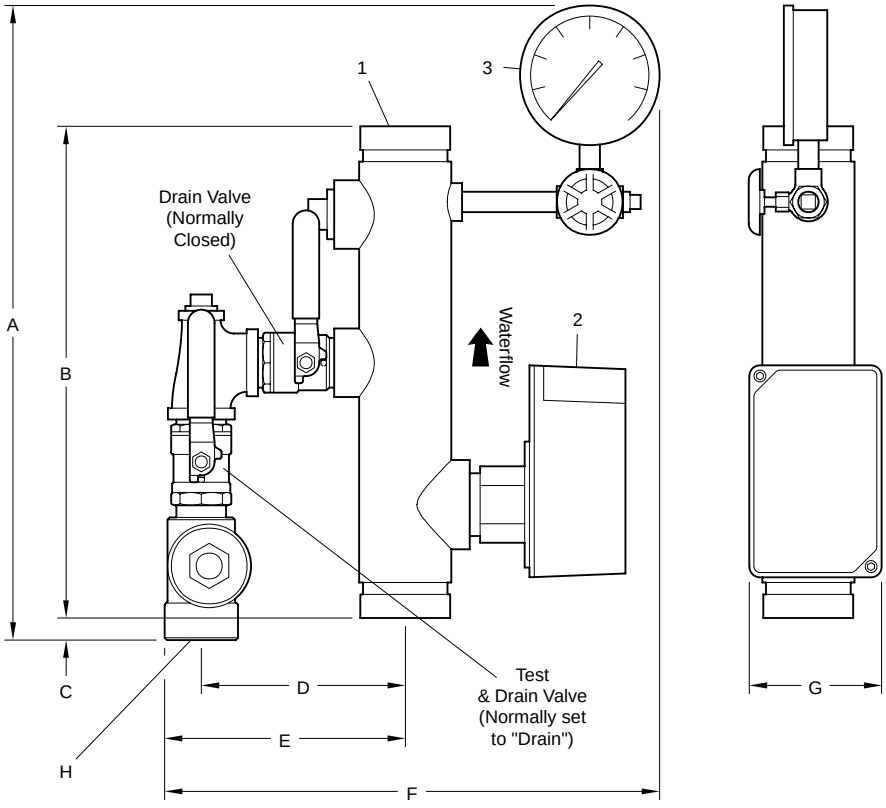
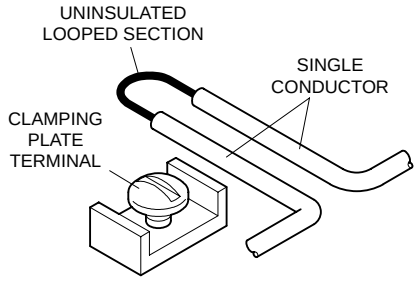


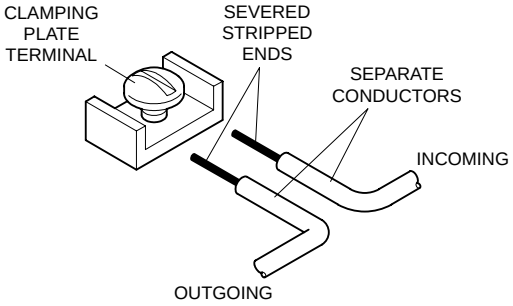
FIGURE 2
2 thru 6 INCH (DN50 thru DN150) RISER MANIFOLD ASSEMBLY AND DIMENSIONS

SWITCH TERMINAL CONNECTIONS



IMPROPER CONNECTION METHOD

CAUTION:
An uninsulated section of a single conductor is not permitted to be looped around the terminal and serve as two separate connections. The wire must be severed to serve as two separate connections, thereby providing supervision of the connection in the event that the wire becomes dislodged from the terminal.

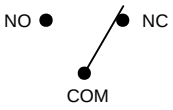


PROPER CONNECTION METHOD

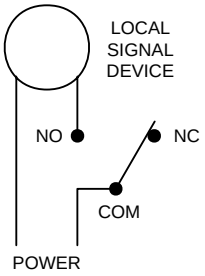
WATERFLOW SWITCH TYPICAL ELECTRICA CONNECTIONS

CONTACTS . . . . . SPDT (Form C)

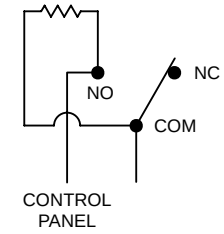
CONTACT RATING . . . . 5A @ 125 VAC
2.5A @ 30 VDC



NO FLOW
CONDITION



NON-SUPERVISED
CIRCUIT



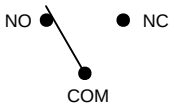
STYLE B/CLASS B
SUPERVISED CIRCUIT
(SEE NOTE)

NOTE:
For supervised circuits, see "Switch Terminal Connections" above. The Waterflow Alarm Switch has two switches, one can be used to operate a central station, proprietary or remove signaling unit, while the other contact is used to operate a local audible or visual annunciator.

COVER TAMPER SWITCH (ULC ASSEMBLIES ONLY)

CONTACTS . . . . . SPDT (Form C)

CONTACT RATING . . . . 3A @ 250 VAC
5A @ 125 VAC
1mA @ 5 VDC min.



CONTACTS SHOWN
WITH COVER IN PLACE

FIGURE 3
WIRING GUIDANCE

NO.	DESCRIPTION	QTY.	P/N
1	3/8" Copper Tubing, 2" (DN50) Manifolds	1	971-124-01
	2-1/2" (DN65) and 3" (DN80) Manifolds	1	971-124-02
	4" (DN100) and 6" (DN150) Manifolds	1	971-124-03

NO.	DESCRIPTION	QTY.	P/N
2	Pressure Relief Valve, 175 psi, Nonadjustable	1	198-066-00
3	90° Compression Fitting Fitting	2	CH
4	1" x 1/2" Reducing Hex Bushing	1	CH

CH: Common Hardware

1-1/2" (DN40) Manifold Only:
To install optional Pressure Relief Trim on a 1-1/2" (DN40) Manifold, a 1/2" NPT outlet must be provided by the installer on the system outlet piping, and a connection back to the manifold drain trim must be fabricated with installer supplied 3/8" copper tubing. Discard unused trim components.

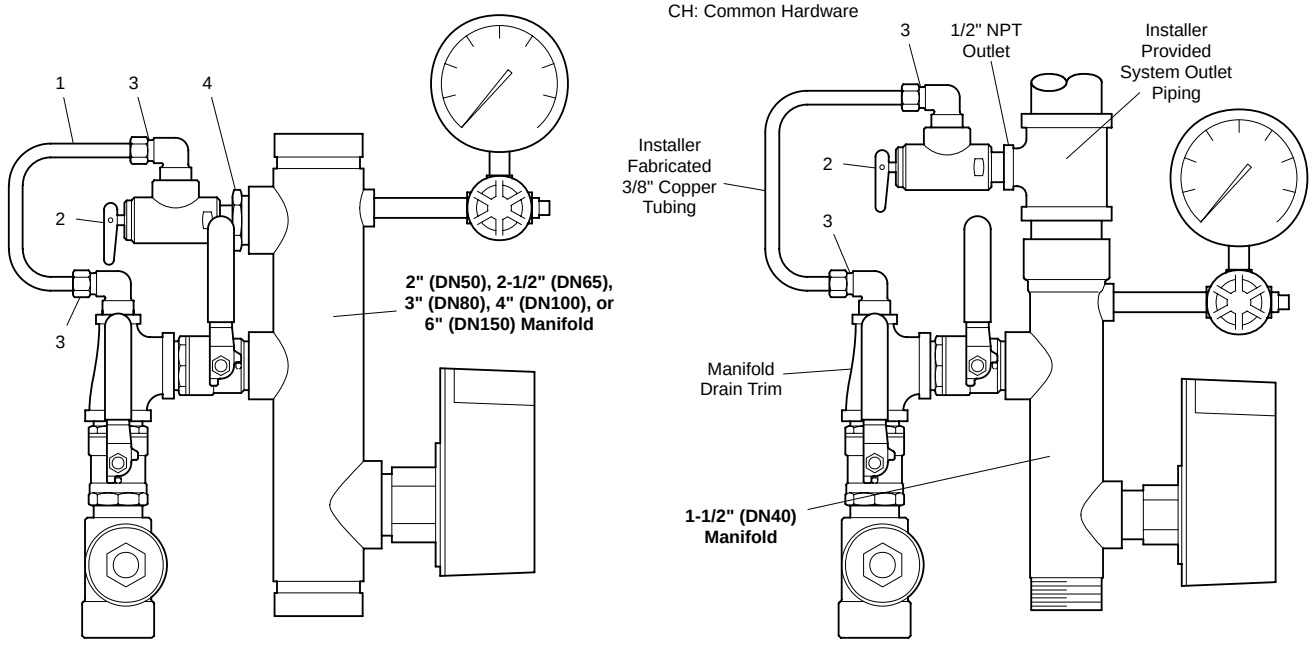


FIGURE 4
OPTIONAL PRESSURE RELIEF VALVE

Care and Maintenance

The following inspection procedure must be performed as indicated, in addition to any specific requirements of the NFPA, and any impairment must be immediately corrected.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

NOTES

No attempt is to be made to repair any Riser Manifold component in the field. Only the pressure gauge, waterflow alarm switch, or relief valve can be replaced. If any other problems are encountered the entire riser manifold must be replaced.

The alarm/flow test procedure will result in operation of the associated alarms. Consequently, notification must be given to the owner and the fire department, central station, or other signal station to which the alarms are connected, and notification must be given to the building occupants.

Before closing a fire protection system control valve for inspection or maintenance work on the fire protection system that it controls, permission to shut down the effected fire protection system must first be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

After placing a fire protection system in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.

Alarm/Flow Test Procedure

Step 1. Place the test & drain Valve in the “test” position.

Step 2. Fully open the drain valve. Make certain that drainage water will not cause any damage or injury.

Step 3. Verify operation of associated alarms.

Step 4. Close the drain valve.

Step 5. Place the test & drain Valve in the “drain” position.

Step 6. Verify that the residual (flowing) pressure indicated by the pressure gauge is no less that originally recorded for the system when it was first installed.

Step 7. Close the drain valve.

Step 8. Verify that the static (not flowing) pressure indicated by the pressure gauge is no less that originally recorded for the system when it was first installed.

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Information

Riser Manifold:
Specify; Size (specify), Figure 513, (specify connection type inlet x outlet) Riser Manifold (specify - without or with) a cover tamper switch for the waterflow alarm switch, P/N (specify).

NOTES

Orders for Figure 513 may be filled with a Figure 13. The two assemblies are completely interchangeable in function, application, and end-to-end laying length.

If a ULC Listing is required, the Riser Manifold must be ordered with a cover tamper switch for the waterflow alarm switch.

UL/ULC/FM Assemblies
With Cover Tamper Switch

1-1/2 Inch (DN40)	
MT x FT	P/N 4086
1-1/2 Inch (DN40)	
MT x MT	P/N 4087
2 Inch (DN50)	
G x G	P/N 4090
2-1/2 Inch (DN65)	
G x G	P/N 4091
3 Inch (DN80)	
G x G	P/N 4092
4 Inch (DN100)	
G x G	P/N 4095
6 Inch (DN150)	
G x G	P/N 4096

UL/FM Assemblies
Without Cover Tamper Switch

1-1/2 Inch (DN40)	
MT x FT	P/N 4055
1-1/2 Inch (DN40)	
MT x MT	P/N 4056
2 Inch (DN50)	
G x G	P/N 4060
2-1/2 Inch (DN65)	
G x G	P/N 4061
3 Inch (DN80)	
G x G	P/N 4062
4 Inch (DN100)	
G x G	P/N 4065
6 Inch (DN150)	
G x G	P/N 4066

Optional Pressure Relief Valve:
Specify: Operational Pressure Relief Valve and Trim for use with (specify size) Figure 513 or 13 Series Riser Manifold, P/N (specify).

1-1/2" or 2"	P/N 4063
2-1/2" or 3"	P/N 4072
4" or 6"	P/N 4073

Replacement Parts:
Specify: (description) for use with Figure 513 or 13 Riser Manifold, P/N (Ref. Figure 1 or 2, as applicable).

VIKING®

TECHNICAL DATA

EASYPAC FLOOR CONTROL RISER MANIFOLD ASSEMBLIES

1-1/4" - 8" (DN32 - DN200)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking EasyPac Floor Control Riser Manifold Assemblies are available in sizes 1-1/4", 1-1/2", 2", 2-1/2", 3", 4", 6" and 8" for commercial use, in high rise buildings requiring floor control assemblies. They are available with an AGF TESTanDRAIN valve, and/or pressure relief valve (PRV) to meet NFPA 13 requirements for gridded systems and any system requiring a pressure relief valve. This configuration eliminates the need to drain the system before installing the relief valve, while a built-in test port allows hydrostatic testing without draining the system.

EasyPac Floor Control Assemblies include pressure gauges, Potter flow switches, 3-way gauge control valve and appropriate drain valve. Easypac assemblies are available in pipe sizes from 1-1/4" to 2-1/2" (DN32 to DN60), and are made with fabricated steel bodies. All Easypac assemblies are available in grooved inlet and outlet connections 1-1/4"-2-1/2" using Schedule 10 steel pipe body. The 1-1/4" to 2" assemblies are also available with male NPT threaded inlets and outlets, or threaded inlets x grooved outlets using Schedule 40 steel pipe.

2. LISTINGS AND APPROVALS

Pressure Gauges: UL Listed, FM Approved
Waterflow Alarm Switch: UL Listed - Category USQT, cUL Listed, FM Approved - Waterflow Detectors, Vane Type, CSFM Listed
Ball Valve: UL Listed, FM Approved
AGF TestanDrain Model 1000: UL Listed - Category VEHZ, FM Approved - Sprinkler System Alarm Testers
AGF TestanDrain Model 1011 with Pressure Relief Valve: UL Listed - Category VEHZ, FM Approved - Sprinkler System Alarm Testers

3. TECHNICAL DATA

Specifications and Material Standards:

Available since 2007.

- Pressure Rating: 250 PSI (17.2 bar) maximum water working pressure.
- Fabricated steel pipe.
- Available in grooved inlet and outlet connections using Schedule 10 steel pipe.
- 1-1/4", 1-1/2", and 2" assemblies are also available with male NPT threaded inlet and outlet, or threaded inlet x grooved outlet using Schedule 40 steel pipe.
- Riser bodies coated with black Ecoat.
- Flow Switch: Two single-pole double-throw switches with Form C contacts rated at 15 Amps 125/250 V. AC, 2.5 Amp 0-30 V. DC. Each switch can be wired for open or closed circuit operation. See Figure 1.

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Ordering Information:

There are three different options are available.
Basic Floor Control EasyPac Assemblies with Ball Valve Drain (See Figure 2)
Floor Control EasyPac Assemblies with TESTanDRAIN Valve (See Figure 3)
Floor Control EasyPac Assemblies with TESTanDRAIN and Pressure Relief Valve (PRV) (See Figure 4)
See Table 1 for Part Numbers.

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.
Note: EasyPac Floor Control Riser Manifold Assemblies can be installed horizontally with flow switch on top, or vertically with flow upward.

Viking EasyPac Riser Assemblies use Potter VSR flow switches. The literature that accompanies the VSR states that the switch should not be installed within 6" of a change of direction of pipe or within 24" of a valve. This is merely a recommendation to reduce the possibility of the switch not operating while minimal waterflow is occurring. This is a recommendation only, not a requirement.

5. TESTANDRAIN VALVE OPERATING INSTRUCTIONS

1. To Test: Turn valve handle counterclockwise from "Off" to "Test". The handle will stop automatically. After test is completed, return handle to "Off".
2. To Drain: Turn handle counterclockwise from "Off" to "Test". The handle will stop automatically. Depress "Push" button and turn handle to "Drain". When system is empty, return handle clockwise to "Off" position.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

Replaces page 32a-f dated dated July 31, 2009. (Removed note regarding the flow switch for Canada orders-now use the same flow switch.)

VIKING®

TECHNICAL DATA

EASYPAC FLOOR CONTROL RISER MANIFOLD ASSEMBLIES

1-1/4" - 8" (DN32 - DN200)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Table 1 - Commercial EasyPac Assemblies

Pipe Size	Inlet / Outlet Connections	Option	Pipe Size	Viking Part Number
1-1/4"	Thread / Thread	Ball Valve	Schedule 40	15267
		TESTanDRAIN		15268
		TESTanDRAIN and PRV		15269
	Groove / Groove	Ball Valve	Schedule 10	15270
		TESTanDRAIN		15271
		TESTanDRAIN and PRV		15272
	Thread / Groove	Ball Valve	Schedule 40	15273
		TESTanDRAIN		15274
		TESTanDRAIN and PRV		15275
1-1/2"	Thread / Thread	Ball Valve	Schedule 40	15276
		TESTanDRAIN		15277
		TESTanDRAIN and PRV		15278
	Groove / Groove	Ball Valve	Schedule 10	15279
		TESTanDRAIN		15280
		TESTanDRAIN and PRV		15281
	Thread / Groove	Ball Valve	Schedule 40	15282
		TESTanDRAIN		15283
		TESTanDRAIN and PRV		15284
2"	Thread / Thread	Ball Valve	Schedule 40	15285
		TESTanDRAIN		15286
		TESTanDRAIN and PRV		15287
	Groove / Groove	Ball Valve	Schedule 10	15288
		TESTanDRAIN		15289
		TESTanDRAIN and PRV		15290
	Thread / Groove	Ball Valve	Schedule 40	15291
		TESTanDRAIN		15292
		TESTanDRAIN and PRV		15293
2-1/2"	Groove / Groove	Ball Valve	Schedule 10	15297
		TESTanDRAIN		15298
		TESTanDRAIN and PRV		15299
3"	Groove / Groove	Ball Valve	Schedule 10	15300
		TESTanDRAIN		15301
		TESTanDRAIN and PRV		15302
4"	Groove / Groove	Ball Valve	Schedule 10	15303
		TESTanDRAIN		15304
		TESTanDRAIN and PRV		15305
6"	Groove / Groove	Ball Valve	Schedule 10	15294
		TESTanDRAIN		15295
		TESTanDRAIN and PRV		15296
8"	Groove / Groove	Ball Valve	Schedule 10	15261
		TESTanDRAIN		15262
		TESTanDRAIN and PRV		15263

TESTanDRAIN Option:
Includes a test orifice with size specified from 3/8" (K2.8) to 25K ESFR*, depending on the smallest sprinkler installed on the system. Must add suffix to the part number for the desired orifice size.
Orifice Suffix:
A = 3/8" (K 2.8)
B = 7/16" (K 4.2)
C = 1/2" (K 5.6)
D = 17/32" (K 8.0)
E = K 11.2 ELO
F = K14 ESFR
G = K25 ESFR

TESTanDRAIN with PRV Option:
Includes test orifice and pressure relief valve. The test orifice must be specified based on the smallest sprinkler installed on the system for 3/8" (K2.8) to K25 ESFR*. The pressure relief valve is not factory assembled to the TestanDrain. Must add suffix to the part number for the desired orifice size and pressure setting of the pressure relief valve.
Orifice Suffix:
A = 3/8" (K 2.8)
B = 7/16" (K 4.2)
C = 1/2" (K 5.6)
D = 17/32" (K 8.0)
E = K 11.2 ELO
F = K14 ESFR
G = K25 ESFR
PRV Suffix:
175
185
195
205
225
250
NOTE: It is important to note that the pressure rating of the relief valve indicates an operating range of pressure for both opening and closing of the valve. Standard relief valves are required to OPEN in a range of pressure between 90% and 105% of their rating. The valves are required to CLOSE at a pressure above 80% of that rating.

* ESFR TESTanDRAIN not available in 1-1/4", 1-1/2" or 2" Risers.

Table 2 - Pipe Diameters

	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	6"	8"
Pipe OD	1.660" (42 mm)	1.900" (48 mm)	2.375" (60 mm)	2.875" (73 mm)	3.5" (89 mm)	4.5" (114 mm)	6.625" (168 mm)	8.625" (219 mm)
Schedule 10 Pipe ID	1.45" (36.6 mm)	1.69" (42.7 mm)	2.16" (54.8 mm)	2.64" (66.9 mm)	3.26" (82.8 mm)	4.26" (108.2 mm)	6.36" (161.5 mm)	8.249" (209.5 mm)
Schedule 40 Pipe ID	1.38" (35.1 mm)	1.61" (40.9 mm)	2.07" (52.5 mm)	N/A	N/A	N/A	N/A	N/A

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7. AVAILABILITY

The Viking EasyPac Floor Control Riser Manifold Assemblies are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

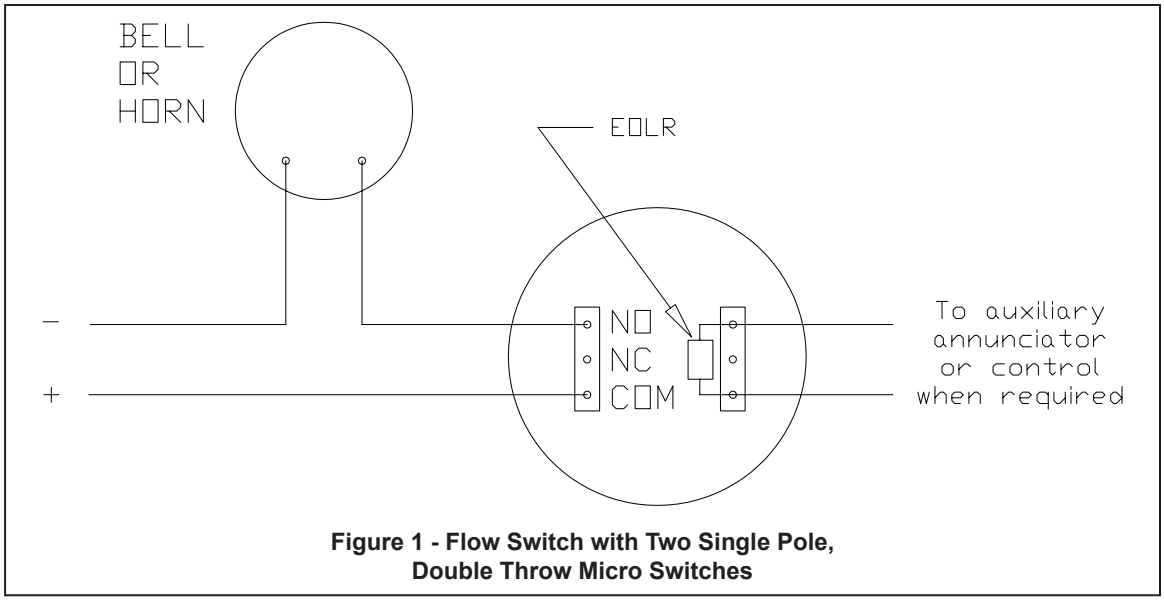

Figure 1 - Flow Switch with Two Single Pole, Double Throw Micro Switches

TECHNICAL DATA

EASYPAC FLOOR CONTROL RISER MANIFOLD ASSEMBLIES

1-1/4” - 8” (DN32 - DN200)

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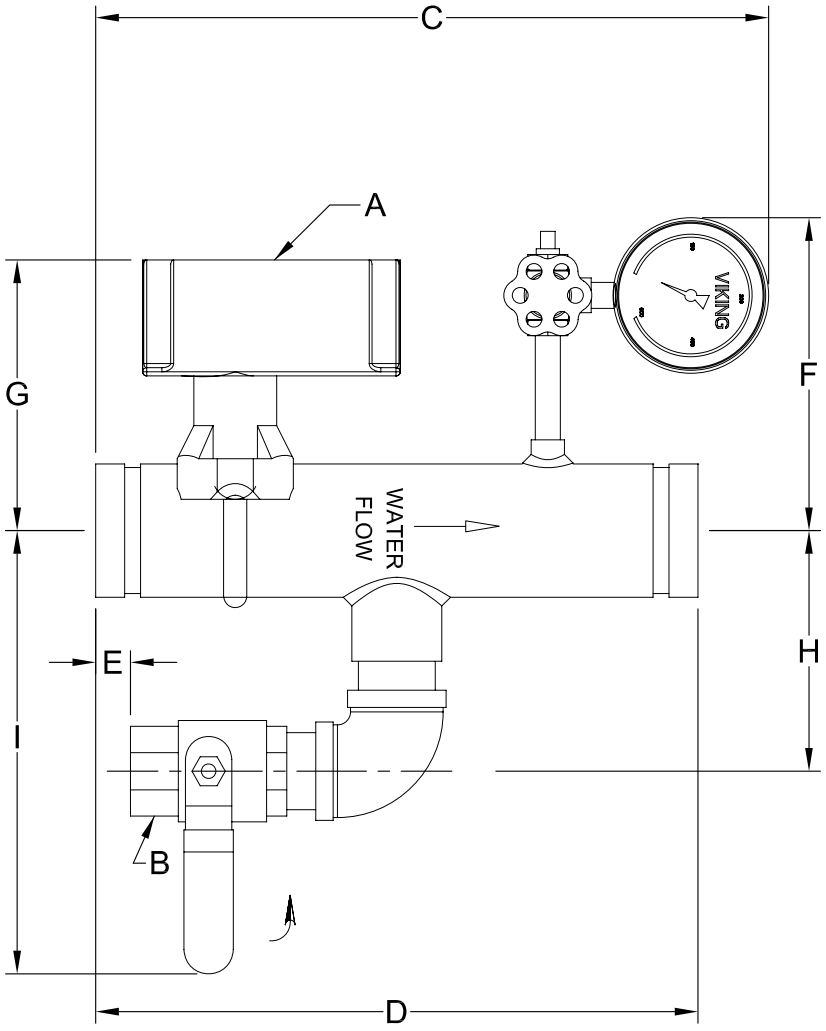

Figure 2 - Basic Floor Control EasyPac

Size	A	B	C	D	E	F	G	H	I
1-1/4” (DN32)	VSR-S Flow Switch[2]	1” NPT	16-1/2” (419)	15” (381)	1-1/2” (38)	6-3/32” (155)	6-11/32” (161)	4-3/16” (107)	8-9/16” (218)
1-1/2” (DN40)	VSR-S Flow Switch[2]	1” NPT	16-1/2” (419)	15” (381)	1-1/2” (38)	7-19/32” (193)	6-15/16” (164)	5-11/16” (144)	10-1/16” (256)
2” (DN50)	VSR Flow Switch[3]	1” NPT	14-1/2” (369)	13” (330)	-15/32” (12)*	6-7/16” (164)	5-51/64” (148”)	4-9/16” (116)	8-59/64” (227)
2-1/2” (DN65)	VSR Flow Switch[3]	1-1/4” NPT	14-1/2” (369)	13” (330)	5/8” (16)	6-11/16” (170)	6-3/64” (154)	5-1/4” (133)	9-39/64” (244)
3” (DN80)	VSR Flow Switch[3]	1-1/4” NPT	14-1/2” (369)	13” (330)	5/8” (16)	7” (178)	6-23/64” (162)	5-9/16” (141)	9-59/64” (252)
4” (DN100)	VSR Flow Switch[3]	2” NPT	14-1/2” (369)	13” (330)	-1-3/4” (-44)[1]	7-1/2” (191)	6-25/32” (173)	7-3/4” (197)	13-5/16” (338)
6” (DN150)	VSR Flow Switch[3]	2” NPT	14-1/2” (369)	13” (330)	-1-3/4” (-44)[1]	8-35/64” (217)	7-53/64” (199)	8-51/64” (223)	14-23/64” (365)
8” (DN200)	VSR Flow Switch[3]	2” NPT	14-3/4” (375)	13” (330)	-1-3/4” (-44)[1]	9-1/2” (243)	8-3/4” (225)	9-3/4” (249)	15-1/2” (391)

[1] Dimension E is negative because the ball valve extends below the end of the manifold body.
[2] Mounted with included nipple (Not Shown)
[3] Mounted with included U bolt (As shown above)

VIKING®

TECHNICAL DATA

EASYPAC FLOOR CONTROL RISER MANIFOLD ASSEMBLIES

1-1/4” - 8” (DN32 - DN200)

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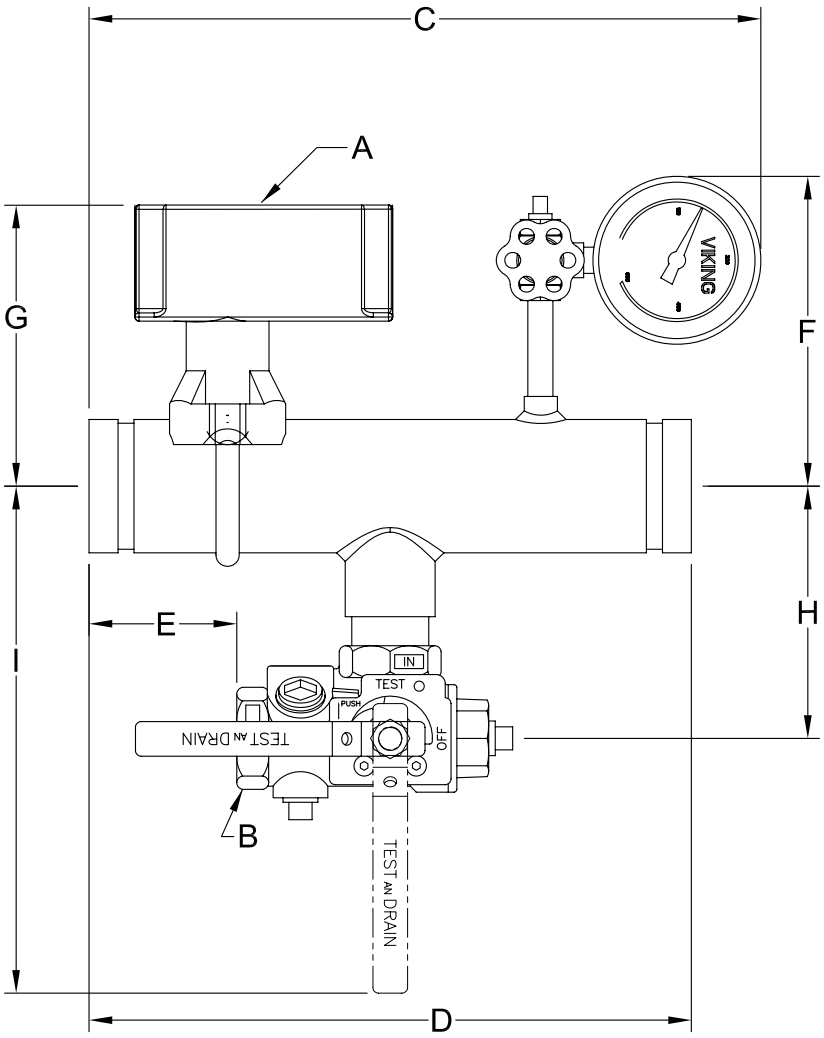

Figure 3 - Floor Control EasyPac with TESTanDRAIN

Size	A	B	C	D	E	F	G	H	I
1-1/4” (DN32)	VSR-S Flow Switch[1]	1” NPT	16-1/2” (419)	15” (381)	5-1/8” (131)	6-3/32” (155)	6-11/32” (161)	4-1/2” (114)	9-3/32” (231)
1-1/2” (DN40)	VSR-S Flow Switch[1]	1” NPT	16-1/2” (419)	15” (381)	5-1/8” (131)	7-19/32” (193)	6-15/16” (164)	4-3/4” (121)	9-7/32” (234)
2” (DN50)	VSR Flow Switch[2]	1” NPT	14-1/2” (369)	13” (330)	3-1/16” (78)	6-7/16” (164)	5-51/64” (148”)	4-49/64” (121)	9-33/64” (242)
2-1/2” (DN65)	VSR Flow Switch[2]	1-1/4” NPT	14-1/2” (369)	13” (330)	3-1/4” (83)	6-11/16” (170)	6-3/64” (154)	6-1/4” (159)	10-61/64” (278)
3” (DN80)	VSR Flow Switch[2]	1-1/4” NPT	14-1/2” (369)	13” (330)	3-1/4” (83)	7” (178)	6-23/64” (162)	5-5/8” (143)	11-17/64” (286)
4” (DN100)	VSR Flow Switch[2]	2” NPT	14-1/2” (369)	13” (330)	2-5/8” (66)	7-1/2” (191)	6-25/32” (173)	8-3/16” (208)	16-3/8” (416)
6” (DN150)	VSR Flow Switch[2]	2” NPT	14-1/2” (369)	13” (330)	2-5/8” (66)	8-35/64” (217)	7-53/64” (199)	9-15/64” (235)	17-27/64” (443)
8” (DN200)	VSR Flow Switch[2]	2” NPT	14-3/4” (375)	13” (330)	2-3/4” (70)	9-1/2” (243)	8-3/4” (225)	10-1/4” (262)	18-1/2” (468)

[1] Mounted with included nipple (Not Shown)
[2] Mounted with included U bolt (As shown above)

TECHNICAL DATA

EASYPAC FLOOR CONTROL RISER MANIFOLD ASSEMBLIES

1-1/4” - 8” (DN32 - DN200)

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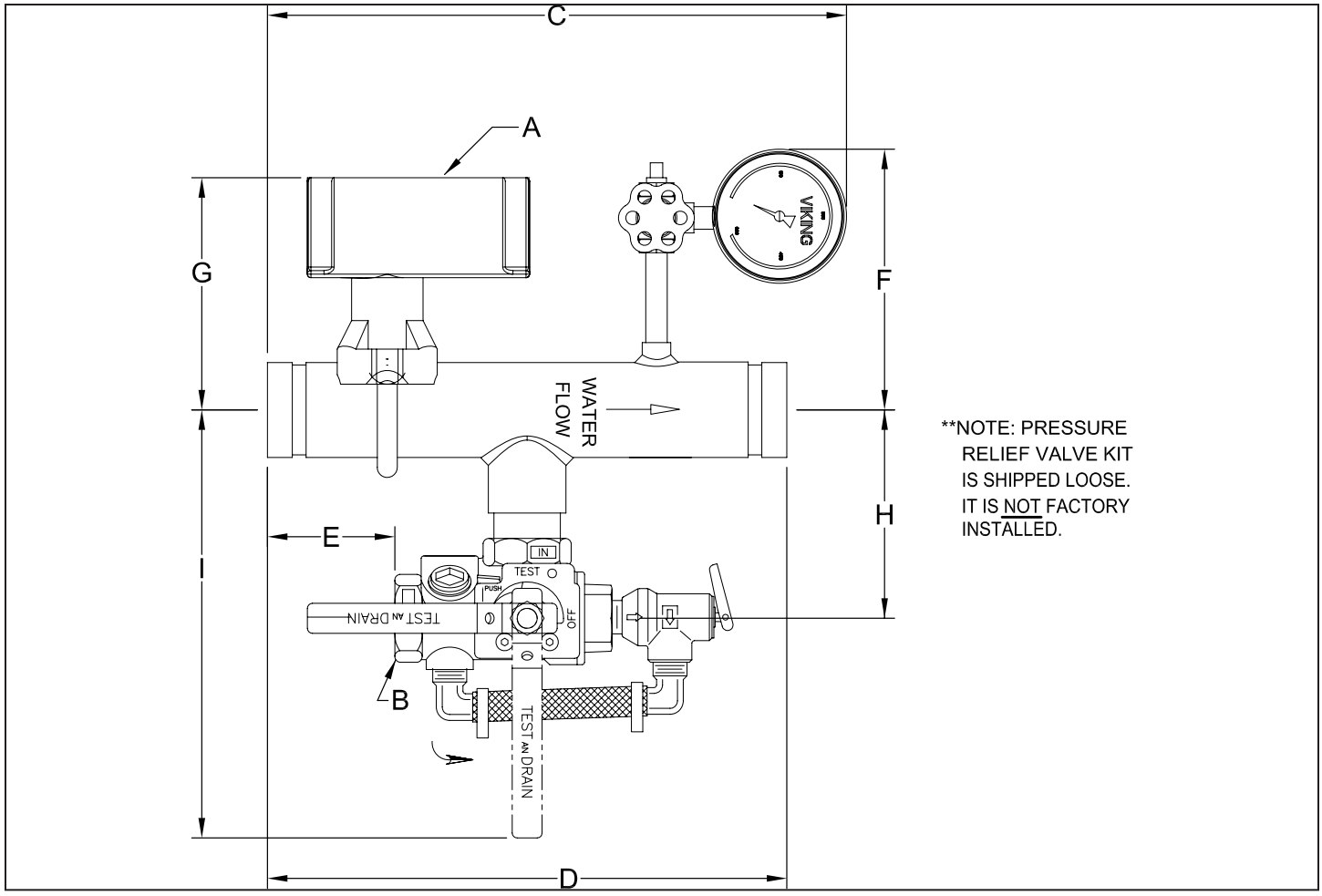


Figure 4 - Floor Control EasyPac with TESTanDRAIN and PRV

Size	A	B	C	D	E	F	G	H	I
1-1/4” (DN32)	VSR-S Flow Switch[1]	1” NPT	16-1/2” (419)	15” (381)	5-1/8” (131)	6-3/32” (155)	6-11/32” (161)	4-1/2” (114)	9-3/32” (231)
1-1/2” (DN40)	VSR-S Flow Switch[1]	1” NPT	16-1/2” (419)	15” (381)	5-1/8” (131)	7-19/32” (193)	6-15/16” (164)	4-3/4” (121)	9-7/32” (234)
2” (DN50)	VSR Flow Switch[2]	1” NPT	14-1/2” (369)	13” (330)	3-1/16” (78)	6-7/16” (164)	4-51/64” (148”)	4-49/64” (121)	10-17/64” (261)
2-1/2” (DN65)	VSR Flow Switch[2]	1-1/4” NPT	14-1/2” (369)	13” (330)	3-1/4” (83)	6-11/16” (170)	6-3/64” (154)	6-1/4” (159)	10-61/64” (278)
3” (DN80)	VSR Flow Switch[2]	1-1/4” NPT	14-1/2” (369)	13” (330)	3-1/4” (83)	7” (178)	6-23/64” (162)	5-5/8” (143)	11-17/64” (286)
4” (DN100)	VSR Flow Switch[2]	2” NPT	14-1/2” (369)	13” (330)	2-5/8” (66)	7-1/2” (191)	6-25/32” (173)	8-3/16” (208)	16-3/8” (416)
6” (DN150)	VSR Flow Switch[2]	2” NPT	14-1/2” (369)	13” (330)	2-5/8” (66)	8-35/64” (217)	7-53/64” (199)	9-15/64” (235)	17-27/64” (443)
8” (DN200)	VSR Flow Switch[2]	2” NPT	14-3/4” (375)	13” (330)	2-3/4” (70)	9-1/2” (243)	8-3/4” (225)	10-1/4” (262)	18-1/2” (468)

[1] Mounted with included nipple (Not Shown)
[2] Mounted with included U bolt (As shown above)

Replaces page 32a-f dated dated July 31, 2009. (Removed note regarding the flow switch for Canada orders-now use the same flow switch.)

Angle Hose Valves

INSIST ON FPPI®

UL, ULC and FM Approved

Description

Angle hose valves feature all brass* construction with forged or cast bodies for rigidity and light weight. Typical uses are in rack assemblies or any other application which requires a listed fire hose valve. Available in rough brass or polished chrome finish with a red hand wheel. **UL, ULC and FM Approved. Rated 300psi**

Installation

Install in accordance with customary installation practices. Use an approved thread sealant such as PipeFit Thread Sealing Paste with PTFE on the male threads to which the valve is being installed.

DO NOT OVER TIGHTEN. Over tightening of the valve during installation to the male pipe threads may crack or deform the valve body. Only use tools suitable for the installation of this product. Do not use pipe wrench extenders to increase leverage on pipe wrenches. This may result in valve damage as well as personal injury.

Specifications

Material:
Cast or Forged Brass* Body

Finish:
Rough Brass
Polished Chrome*

Threads:

2½"	FNPT	x	FNPT
	FNPT	x	MNST*
			MBCT
			MQST
			MONT
			MPHX
			MTEM
			MCLV
2½"	GRV	x	FNPT
	GRV	x	MNST
1½"	FNPT	x	FNPT
	FNPT	x	MNST

Friction loss is less than 3 psi thru an equivalent length of pipe per UL Standards.

*Contains lead. Not for use in water systems intended for human consumption.

3198 LIONSHEAD AVE
CARLSBAD, CA 92010
TEL + 1 760 599-1168
+ 1 800 344-1822
FAX + 1 800 344-3775

UL LISTED c UL LISTED FM APPROVED

VSR
VANE TYPE WATERFLOW ALARM SWITCH WITH RETARD

UL, CUL and CSFM Listed, FM Approved, LPCB Approved, For CE Marked (EN12259-5) / VdS Approved model use VSR-EU

Service Pressure: 450 PSI (31 BAR) - UL

Flow Sensitivity Range for Signal:
4-10 GPM (15-38 LPM) - UL

Maximum Surge: 18 FPS (5.5 m/s)

Contact Ratings: Two sets of SPDT (Form C)
10.0 Amps at 125/250VAC
2.0 Amps at 30VDC Resistive
10 mAmps min. at 24VDC

Conduit Entrances: Two knockouts provided for 1/2" conduit. Individual switch compartments suitable for dissimilar voltages.

Environmental Specifications:

- NEMA 4/IP54 Rated Enclosure suitable for indoor or outdoor use with factory installed gasket and die-cast housing when used with appropriate conduit fitting.
- Temperature Range: 40°F - 120°F, (4.5°C - 49°C) - UL
- Non-corrosive sleeve factory installed in saddle.

Service Use:

Automatic Sprinkler	NFPA-13
One or two family dwelling	NFPA-13D
Residential occupancy up to four stories	NFPA-13R
National Fire Alarm Code	NFPA-72

Specifications subject to change without notice.

Ordering Information			
Nominal Pipe Size		Model	Part Number
2"	DN50	VSR-2	1144402
2 1/2"	DN65	VSR-2 1/2	1144425
3"	DN80	VSR-3	1144403
3 1/2"	-	VSR-3 1/2	1144435
4"	DN100	VSR-4	1144404
5"	-	VSR-5	1144405
6"	DN150	VSR-6	1144406
8"	DN200	VSR-8	1144408

Optional: Cover Tamper Switch Kit, stock no. 0090148
Replaceable Components: Retard/Switch Assembly, stock no. 1029030

⚠ WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Shock hazard. Disconnect power source before servicing. Serious injury or death could result.
- Risk of explosion. Not for use in hazardous locations. Serious injury or death could result.

CAUTION

Waterflow switches that are monitoring wet pipe sprinkler systems shall not be used as the sole initiating device to discharge AFFF, deluge, or chemical suppression systems. Waterflow switches used for this application may result in unintended discharges caused by surges, trapped air, or short retard times.

General Information

The Model VSR is a vane type waterflow switch for use on wet sprinkler systems. It is UL Listed and FM Approved for use on steel pipe; schedules 10 through 40, sizes 2" thru 8" (50 mm thru 200 mm). LPC approved sizes are 2" thru 8" (50 mm thru 200 mm). See Ordering Information chart.

The VSR may also be used as a sectional waterflow detector on large systems. The VSR contains two single pole, double throw, snap action switches and an adjustable, instantly recycling pneumatic retard. The switches are actuated when a flow of 10 GPM (38 LPM) or more occurs downstream of the device. The flow condition must exist for a period of time necessary to overcome the selected retard period.

Enclosure

The VSR switches and retard device are enclosed in a general purpose, die-cast housing. The cover is held in place with two tamper resistant screws which require a special key for removal. A field installable cover tamper switch is available as an option which may be used to indicate unauthorized removal of the cover. See bulletin number 5401103 for installation instructions of this switch.

VSR
VANE TYPE WATERFLOW ALARM SWITCH WITH RETARD

Installation (see Fig. 1)

These devices may be mounted on horizontal or vertical pipe. On horizontal pipe they shall be installed on the top side of the pipe where they will be accessible. The device should not be installed within 6" (15 cm) of a fitting which changes the direction of the waterflow or within 24" (60 cm) of a valve or drain.

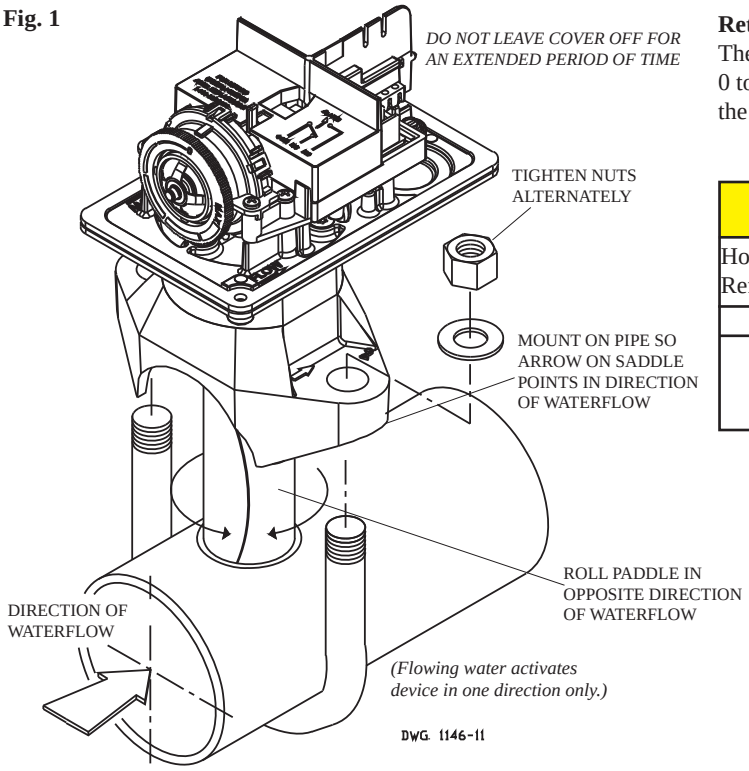
NOTE: Do not leave cover off for an extended period of time.

Drain the system and drill a hole in the pipe using a hole saw in a slow speed drill (see Fig. 1). Clean the inside pipe of all growth or other material for a distance equal to the pipe diameter on either side of the hole. Roll the vane so that it may be inserted into the hole; do not bend or crease it. Insert the vane so that the arrow on the saddle points in the direction of the waterflow. Take care not to damage the non-corrosive bushing in the saddle. The bushing should fit inside the hole in the pipe. Install the saddle strap and tighten nuts alternately to required torque (see the chart in Fig. 1). The vane must not rub the inside of the pipe or bind in any way.

⚠ CAUTION

Do not trim the paddle. Failure to follow these instructions may prevent the device from operating and will void the warranty.

Fig. 1

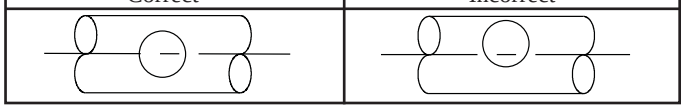


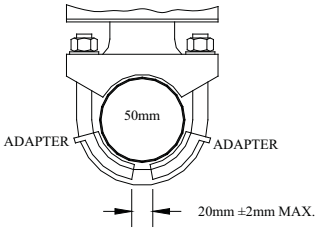
Retard Adjustment

The delay can be adjusted by rotating the retard adjustment knob from 0 to the max setting (60-90 seconds). The time delay should be set at the minimum required to prevent false alarms

CAUTION

Hole must be drilled perpendicular to the pipe and vertically centered. Refer to the Compatible Pipe/Installation Requirements chart for size.





DN50 ONLY

USE (2) 5180162 ADAPTERS AS SHOWN ABOVE

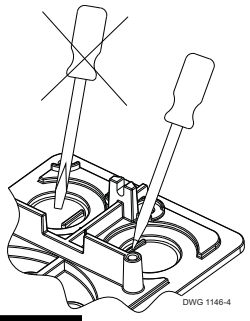
DWG# 1146-1F

Compatible Pipe/ Installation Requirements

Model	Nominal Pipe Size		Nominal Pipe O.D.		Pipe Wall Thickness								Hole Size		U-Bolt Nuts Torque	
					Schedule 10 (UL)		Schedule 40 (UL)		BS-1387 (LPC)		DN (VDS)					
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	ft-lb	n-m
VSR-2	2	DN50	2.375	60.3	0.109	2.77	0.154	3.91	0.142	3.6	0.091	2.3	1.25 + .125/-.062	33.0 ± 2.0	20	27
VSR-2 1/2	2.5	-	2.875	73.0	0.120	3.05	0.203	5.16	-	-	-	-				
VSR-2 1/2	-	DN65	3.000	76.1	-	-	-	-	0.142	3.6	0.102	2.6				
VSR-3	3	DN80	3.500	88.9	0.120	3.05	0.216	5.49	0.157	4.0	0.114	2.9	2.00 ± .125	50.8 ± 2.0		
VSR-3 1/2	3.5	-	4.000	101.6	0.120	3.05	0.226	5.74	-	-	-	-				
VSR-4	4	DN100	4.500	114.3	0.120	3.05	0.237	6.02	0.177	4.5	0.126	3.2				
VSR-5	5	-	5.563	141.3	0.134	3.40	0.258	6.55	-	-	-	-				
VSR-6	6	DN150	6.625	168.3	0.134	3.40	0.280	7.11	0.197	5.0	0.157	4.0				
VSR-8	8	DN200	8.625	219.1	0.148	3.76	0.322	8.18	0.248	6.3	0.177	4.5				

NOTE: For copper or plastic pipe use Model VSR-CF.

Fig. 2
To remove knockouts: Place screwdriver at inside edge of knockouts, not in the center.



NOTICE
Do not drill into the base as this creates metal shavings which can create electrical hazards and damage the device. Drilling voids the warranty.

Fig. 3
Break out thin section of cover when wiring both switches from one conduit entrance.

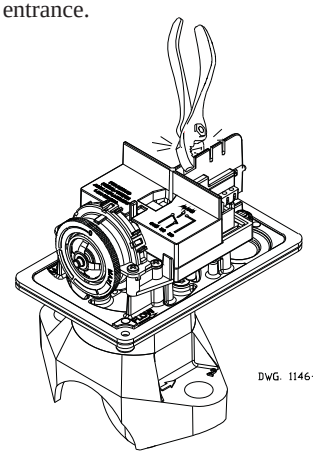
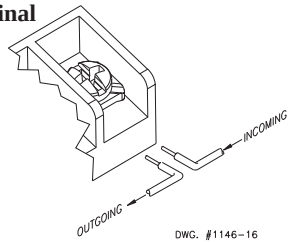


Fig. 4 Switch Terminal Connections Clamping Plate Terminal

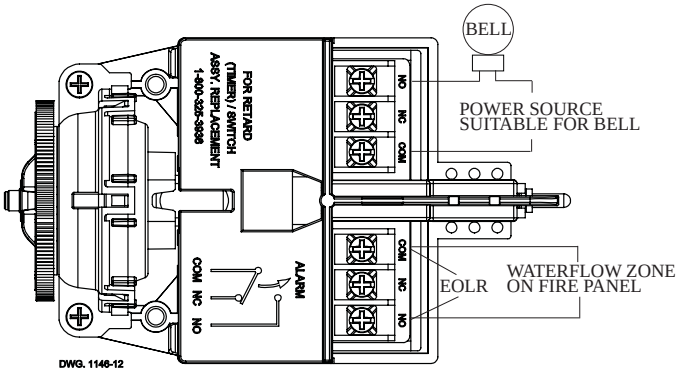


WARNING
An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire become dislodged from under the terminal. Failure to sever the wire may render the device inoperable risking severe property damage and loss of life.

Do not strip wire beyond 3/8" of length or expose an uninsulated conductor beyond the edge of the terminal block. When using stranded wire, capture all strands under the clamping plate.

Fig. 5 Typical Electrical Connections

Notes:
1. The Model VSR has two switches, one can be used to operate a central station, proprietary or remote signaling unit, while the other contact is used to operate a local audible or visual annunciator.
2. A condition of LPC Approval of this product is that the electrical entry must be sealed to exclude moisture.
3. For supervised circuits, see "Switch Terminal Connections" drawing and warning note (Fig. 4).

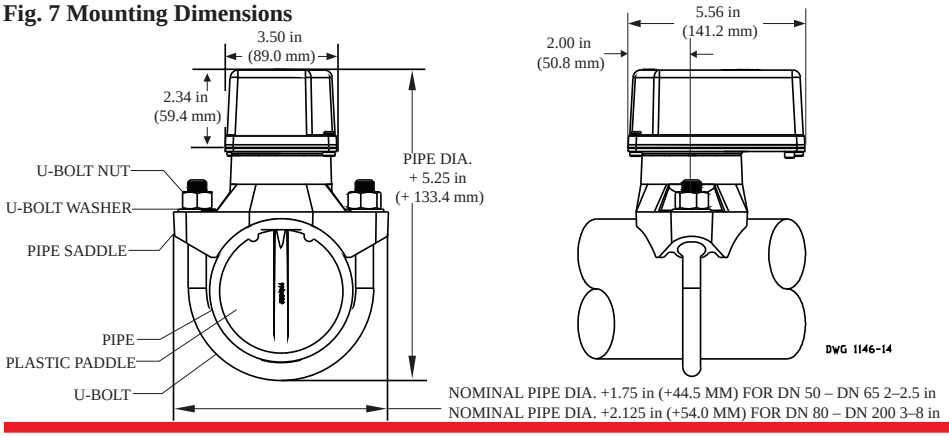


Testing
The frequency of inspection and testing for the Model VSR and its associated protective monitoring system shall be in accordance with applicable NFPA Codes and Standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

If provided, the inspector's test valve shall always be used for test purposes. If there are no provisions for testing the operation of the flow detection device on the system, application of the VSR is not recommended or advisable.
A minimum flow of 10 GPM (38 LPM) is required to activate this device.

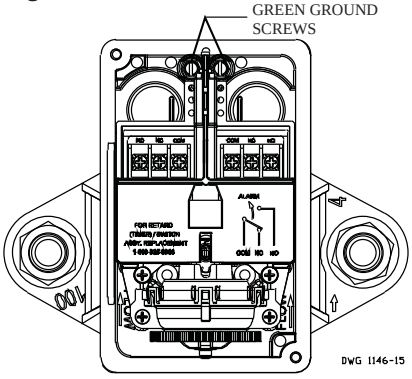
NOTICE Advise the person responsible for testing of the fire protection system that this system must be tested in accordance with the testing instructions.

Fig. 7 Mounting Dimensions



NOMINAL PIPE DIA. +1.75 in (+44.5 MM) FOR DN 50 – DN 65 2–2.5 in
NOMINAL PIPE DIA. +2.125 in (+54.0 MM) FOR DN 80 – DN 200 3–8 in

Fig. 8



Maintenance

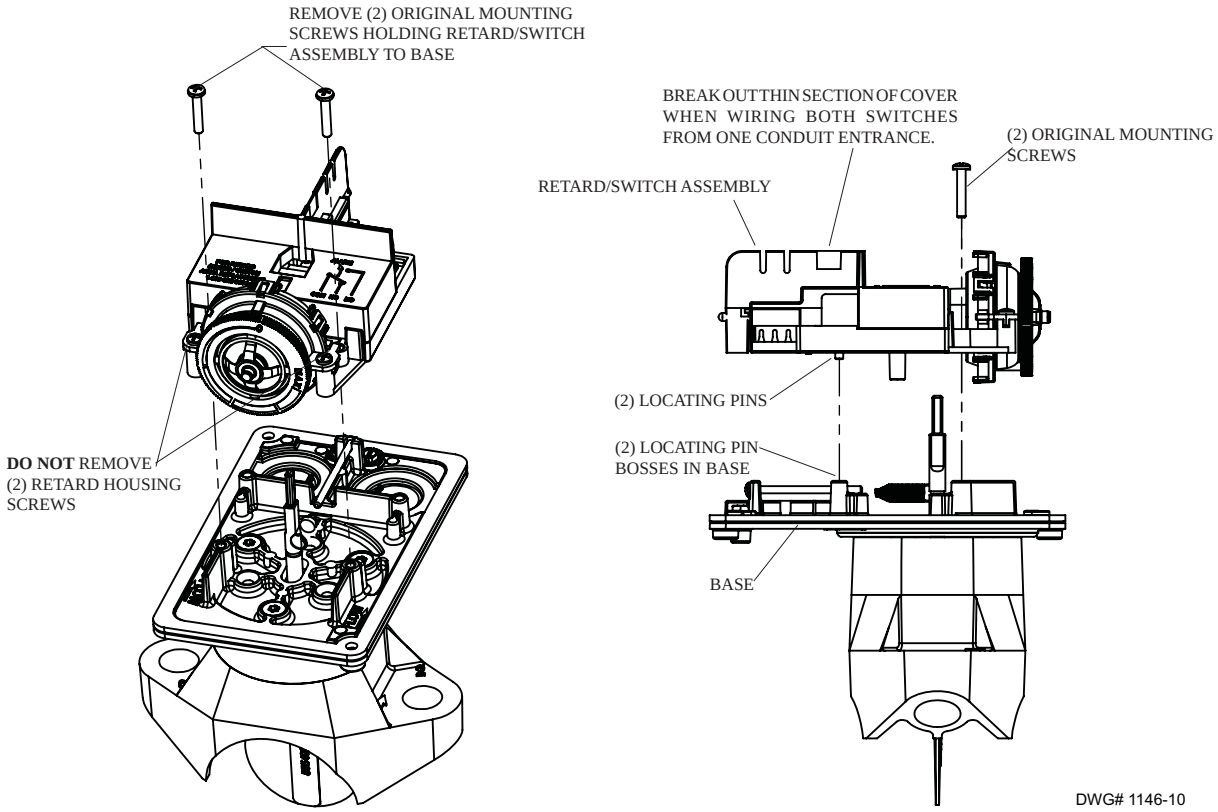
Inspect detectors monthly. If leaks are found, replace the detector. The VSR waterflow switch should provide years of trouble-free service. The retard and switch assembly are easily field replaceable. In the unlikely event that either component does not perform properly, please order replacement retard switch assembly stock #1029030 (see Fig. 6). There is no maintenance required, only periodic testing and inspection.

Retard/Switch Assembly Replacement (See Fig. 6)

NOTICE The Retard/Switch Assembly is field-replaceable without draining the system or removing the waterflow switch from the pipe

1. Make sure the fire alarm zone or circuit connected to the waterflow switch is bypassed or otherwise taken out of service.
2. Disconnect the power source for local bell (if applicable).
3. Identify and remove all wires from the waterflow switch.
4. Remove the (2) mounting screws holding retard/switch assembly to the base. **Do not** remove the (2) retard housing screws.
5. Remove the retard assembly by lifting it straight up over the tripstem.
6. Install the new retard assembly. Make sure the locating pins on the retard/switch assembly fit into the locating pin bosses on the base.
7. Re-install the (2) original mounting screws.
8. Reconnect all wires. Perform a flow test and place the system back in service.

Fig. 6



Removal of Waterflow Switch

- To prevent accidental water damage, all control valves should be shut tight and the system completely drained before waterflow detectors are removed or replaced.
- Turn off electrical power to the detector, then disconnect wiring.
- Loosen nuts and remove U-bolts.
- Gently lift the saddle far enough to get your fingers under it. With your fingers, roll the vane so it will fit through the hole while continuing to lift the waterflow detector saddle.
- Lift detector clear of pipe.

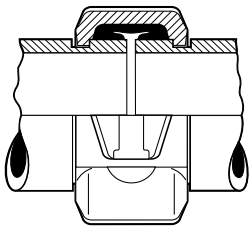
Flexible Coupling

STYLE 75

SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

Style 75 is available where moderate pressures are expected or weight considerations are a factor. Up to 50% lighter in weight than the Style 77, the Style 75 coupling is recommended for service up to 500 psi/3450 kPa depending on size. Housings are cast in two identical pieces in all sizes. Hot-dip galvanized and special coatings are available for all sizes.

The Victaulic standard flexible coupling offering for grade "EHP" or "T" gaskets is the Style 177 installation-ready flexible coupling. For all available sizes, the Style 177 is the standard flexible coupling Victaulic supplies in North America for piping systems using Grade "EHP" or "T" gaskets. Contact Victaulic for further details.



Exaggerated for clarity

MATERIAL SPECIFICATIONS

Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Housing Coating: Orange enamel.
- **Optional:** Hot dipped galvanized and others.

Gasket: (specify choice*)

- **Grade "E" EPDM**
  EPDM (Green color code). Temperature range –30°F to +230°F/–34°C to +110°C. Recommended for hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL classified in accordance with ANSI/NSF 61 for cold +86°F/+30°C and hot +180°F/+82°C potable water service. NOT RECOMMENDED FOR PETROLEUM SERVICES.

- **Grade "T" nitrile**
  Nitrile (Orange color code). Temperature range –20°F to +180°F/–29°C to +82°C. Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range; except hot, dry air over +140°F/+60°C and water over +150°F/+66°C. NOT RECOMMENDED FOR HOT WATER SERVICES.

* Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

NOTE: Additional gasket styles are available. Contact Victaulic for details.

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

JOB/OWNER
System No. _____
Location _____

CONTRACTOR
Submitted By _____
Date _____

ENGINEER
Spec Sect _____ Para _____
Approved _____
Date _____

www.victaulic.com

Flexible Coupling

STYLE 75

DIMENSIONS

Size		Max. Work Pressure *	Max. End Load *	Allow. Pipe End Sep. †	Deflect. Fr. C_L†		Bolt/Nut@ No – Size	Dimensions – Inches/mm			Approx. Wgt. Each
Nominal Size Inches mm	Actual Outside Diameter Inches mm	psi kPa	Lbs. N	Inches mm	Per Cplg. Deg.	Pipe In./Ft. mm/m	Inches	X	Y	Z	Lbs. kg
1 25	1.315 33.4	500 3450	680 3025	0 – 0.06 0 – 1.6	2° – 43′	0.57 48	2 – ⅜ x 2	2.38 61	4.27 108	1.77 45	1.3 0.6
1 ¼ 32	1.660 42.2	500 3450	1080 4805	0 – 0.06 0 – 1.6	2° – 10′	0.45 38	2 – ⅜ x 2	2.68 68	4.61 117	1.77 45	1.4 0.6
1 ½ 40	1.900 48.3	500 3450	1420 6320	0 – 0.06 0 – 1.6	1° – 56′	0.40 33	2 – ⅜ x 2	2.91 74	4.82 122	1.77 45	1.5 0.6
2 50	2.375 60.3	500 3450	2215 9860	0 – 0.06 0 – 1.6	1° – 31′	0.32 26	2 – ⅜ x 2	3.43 87	5.22 133	1.88 48	1.7 0.8
2 ½ 65	2.875 73.0	500 3450	3245 14440	0 – 0.06 0 – 1.6	1° – 15′	0.26 22	2 – ⅜ x 2	3.88 98	5.68 144	1.88 48	1.9 0.9
76.1 mm	3.000 76.1	500 3450	3535 15730	0 – 0.06 0 – 1.6	1° – 12′	0.26 22	2 – ⅜ x 2	4.00 102	5.90 150	1.88 48	1.9 0.9
3 80	3.500 88.9	500 3450	4800 21360	0 – 0.06 0 – 1.6	1° – 2′	0.22 18	2 – ½ x 2¾	4.50 114	7.00 178	1.88 48	2.9 1.3
3 ½ 90	4.000 101.6	500 3450	6300 28035	0 – 0.06 0 – 1.6	0° – 54′	0.19 16	2 – ½ x 2¾	5.00 127	7.50 191	1.88 48	2.9 1.3
4 100	4.500 114.3	500 3450	7950 35380	0 – 0.13 0 – 3.2	1° – 36′	0.34 28	2 – ½ x 2¾	5.80 147	8.03 204	2.13 54	4.1 1.9
108.0 mm	4.250 108.0	450 3100	6380 28395	0 – 0.13 0 – 3.2	1° – 41′	0.35 29	2 – 12 x 70.0	5.55 141	7.79 198	2.13 54	3.7 1.7
4 ½ 120	5.000 127.0	450 3100	8820 39250	0 – 0.13 0 – 3.2	1° – 26′	0.25 21	2 – ⅝ x 3 ¼	6.13 156	9.43 240	2.13 54	5.5 2.5
5 125	5.563 141.3	450 3100	10935 48660	0 – 0.13 0 – 3.2	1° – 18′	0.27 23	2 – ⅝ x 3 ¼	6.88 175	10.07 256	2.13 54	5.8 2.6
133.0 mm	5.250 133.0	450 3100	9735 43325	0 – 0.13 0 – 3.2	1° – 21′	0.28 24	2 – 16 x 82.5	6.55 166	9.37 238	2.13 54	6.0 2.7
139.7 mm	5.500 139.7	450 3100	10665 47460	0 – 0.13 0 – 3.2	1° – 18′	0.28 24	2 – ⅝ x 3 ¼	6.80 173	9.59 244	2.13 54	6.3 2.9
152.4 mm	6.000 152.4	450 3100	12735 56670	0 – 0.13 0 – 3.2	1° – 12′	0.21 18	2 – ⅝ x 3 ¼	7.38 187	10.48 266	1.88 48	6.2 2.8
6 150	6.625 168.3	450 3100	15525 69085	0 – 0.13 0 – 3.2	1° – 5′	0.23 18	2 – ⅝ x 3 ¼	8.00 203	11.07 281	2.13 54	7.0 3.2
159.0 mm	6.250 159.0	450 3100	13800 61405	0 – 0.13 0 – 3.2	1° – 9′	0.24 20	2 – 16 x 82.5	7.63 194	10.49 266	2.13 54	6.8 3.1
8 200	8.625 219.1	450 3100	26280 116945	0 – 0.13 0 – 3.2	0° – 50′	0.18 14	2 – ¾ x 4 ¼	10.34 263	13.97 355	2.32 59	12.4 5.6

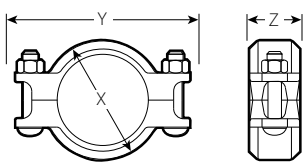
* Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1 1/2 times the figures shown.

† Allowable Pipe End Separation and Deflection figures show the maximum nominal range of movement available at each joint for standard roll grooved pipe. Figures for standard cut grooved pipe may be doubled. These figures are maximums; for design and installation purposes these figures should be reduced by: 50% for ¾ – 3 1/2″/20 – 90 mm; 25% for 4″/100 mm and larger.

@ Number of bolts required equals number of housing segments.

Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.



Flexible Coupling

STYLE 75

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

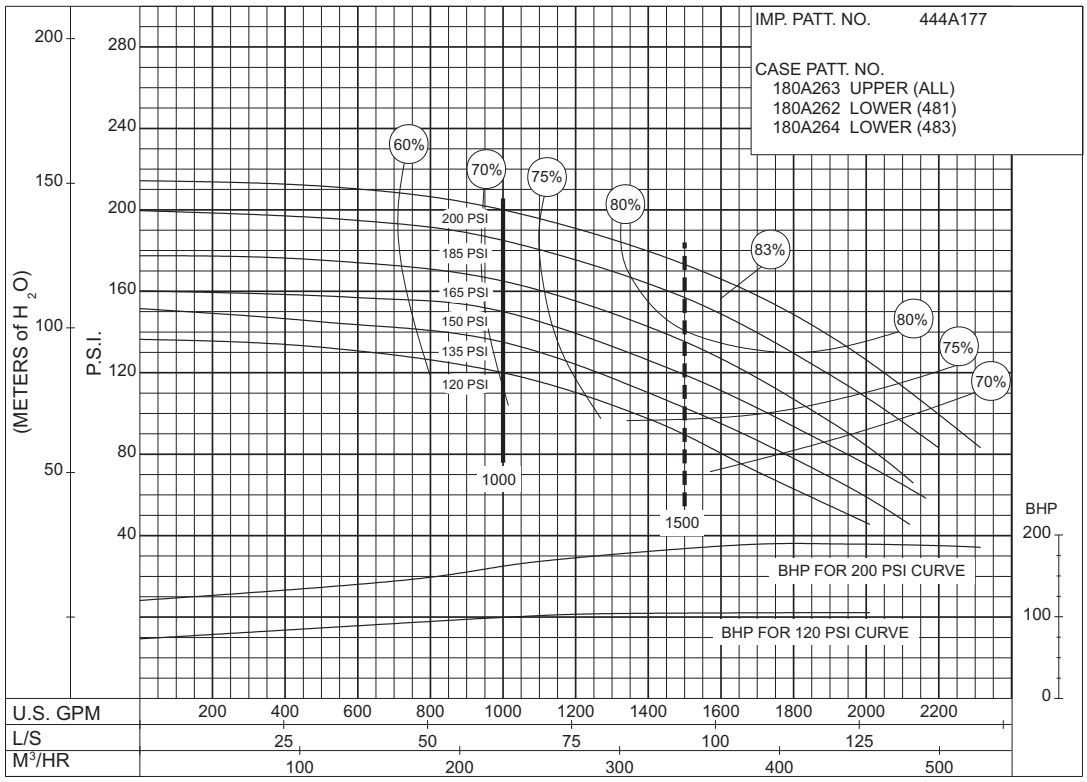
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

06.05 1470 REV M UPDATED 2/2011

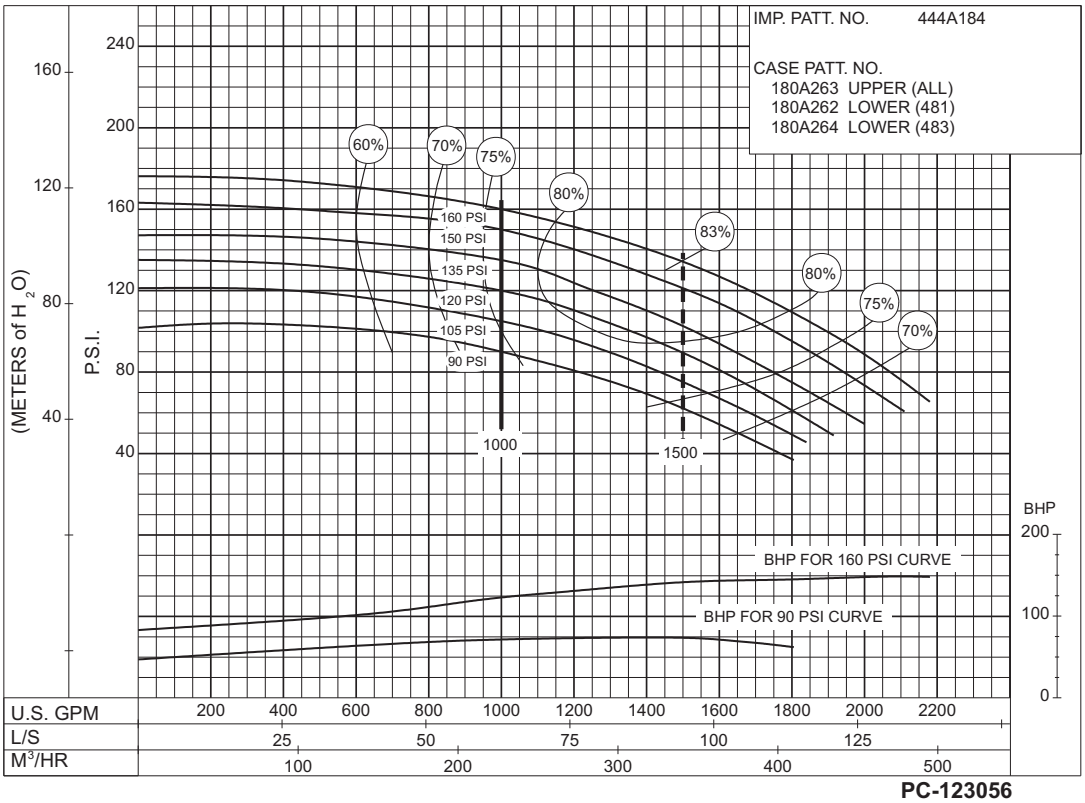
SIZE : 5”1822BF / 5”1842BF **MODEL: 1800** **IMPELLER : Enclosed** **R. P. M. : 3560**



PC-123055

120 to 200 P.S.I.

SIZE : 5”1822CF / 5”1842CF **MODEL: 1800** **IMPELLER : Enclosed** **R. P. M. : 3560**



PC-123056

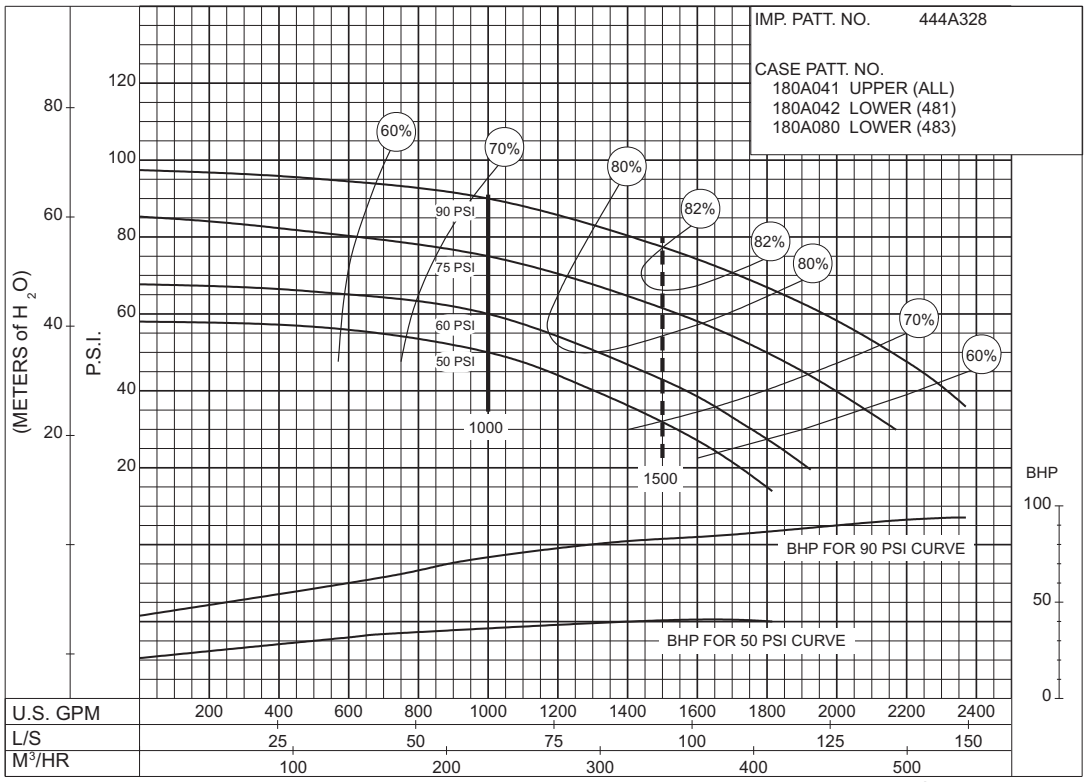
90 to 160 P.S.I.

1000 G.P.M. 912 SERIES

ELECTRIC MOTOR DRIVE

50 to 90 P.S.I.

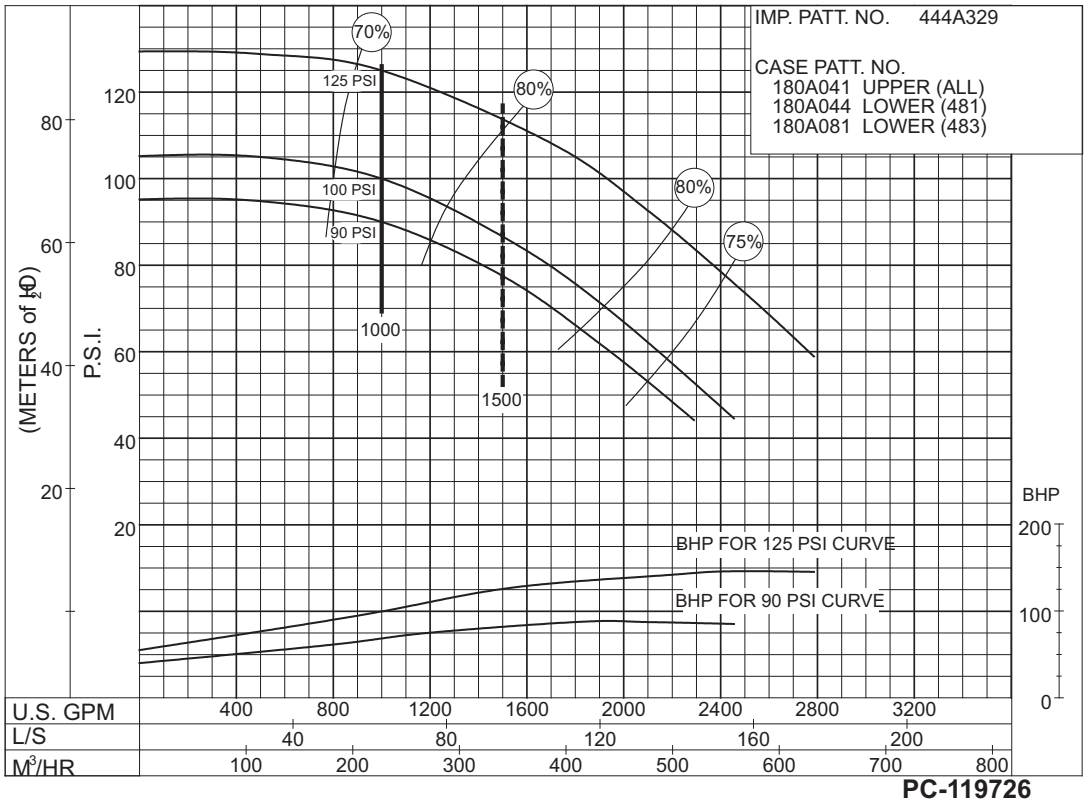
SIZE : 5”1823F / 5”1843F **MODEL: 1800** **IMPELLER : Enclosed** **R. P. M. : 1770**



PC-119725

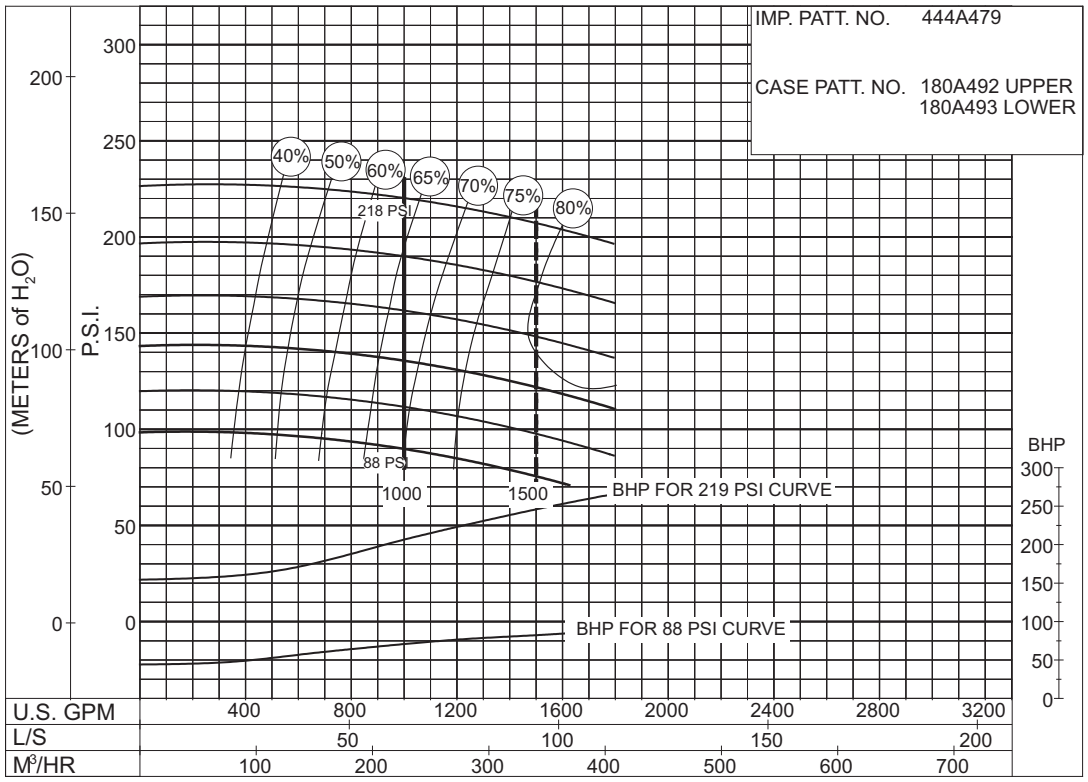
90 to 125 P.S.I.

SIZE : 5”1824F / 5”1844F **MODEL: 1800** **IMPELLER : Enclosed** **R. P. M. : 1770**



PC-119726

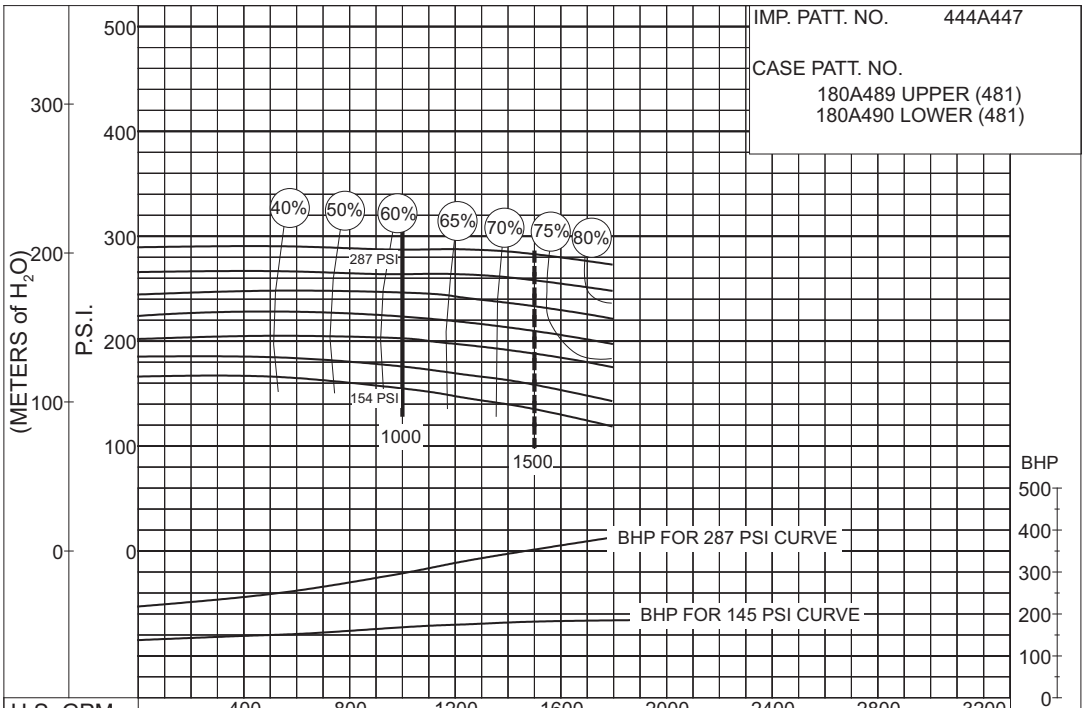
SIZE : 6”1822HHF **MODEL: 1800** **IMPELLER : Enclosed** **R. P. M. : 3560**



PC - 186044

88 to 218 P.S.I.

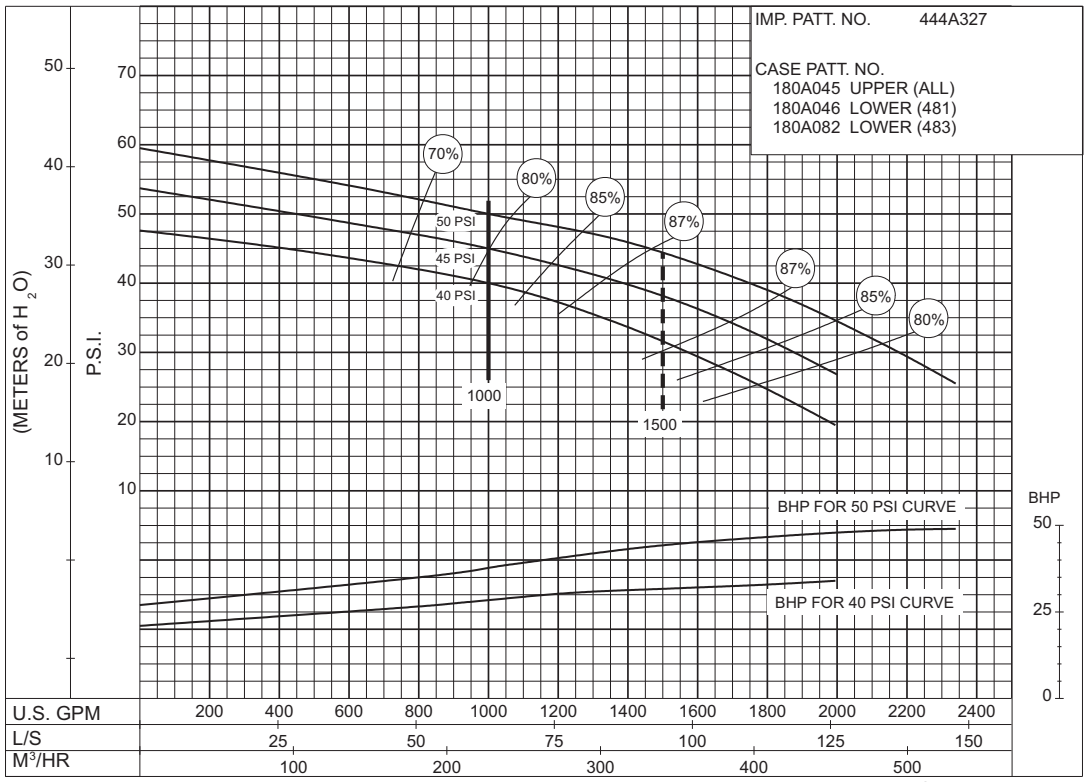
SIZE : 6”1823HHF **MODEL: 1800** **IMPELLER : Enclosed** **R. P. M. : 3560**



DRAWN BY: APPROVED BY: DATE : 11/4/04 **PC - 185603**

154 to 287 P.S.I.

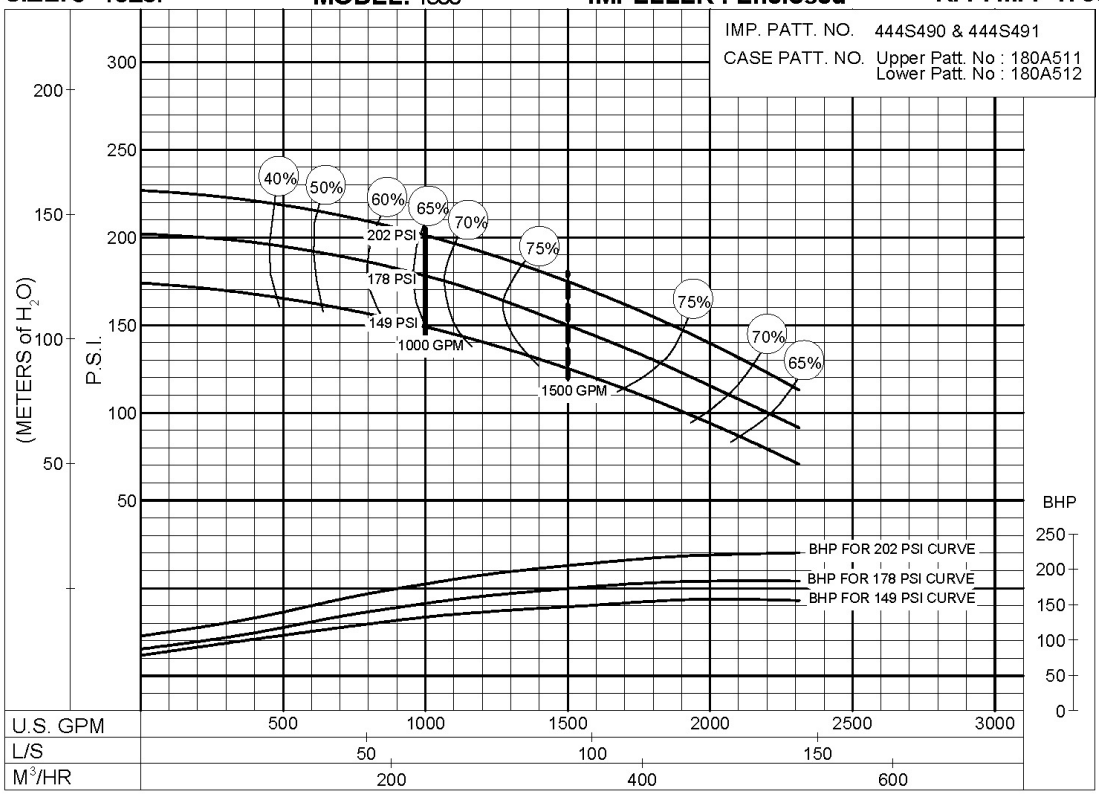
SIZE : 6"1822F / 6"1842F **MODEL: 1800** **IMPELLER : Enclosed** **R. P. M. : 1770**



PC-117433

40 to 50 P.S.I.

SIZE: 6" 1923F **MODEL:** 1900 **IMPELLER : Enclosed** **R. P. M. : 1780**



PC- 200247

149 to 202 P.S.I.

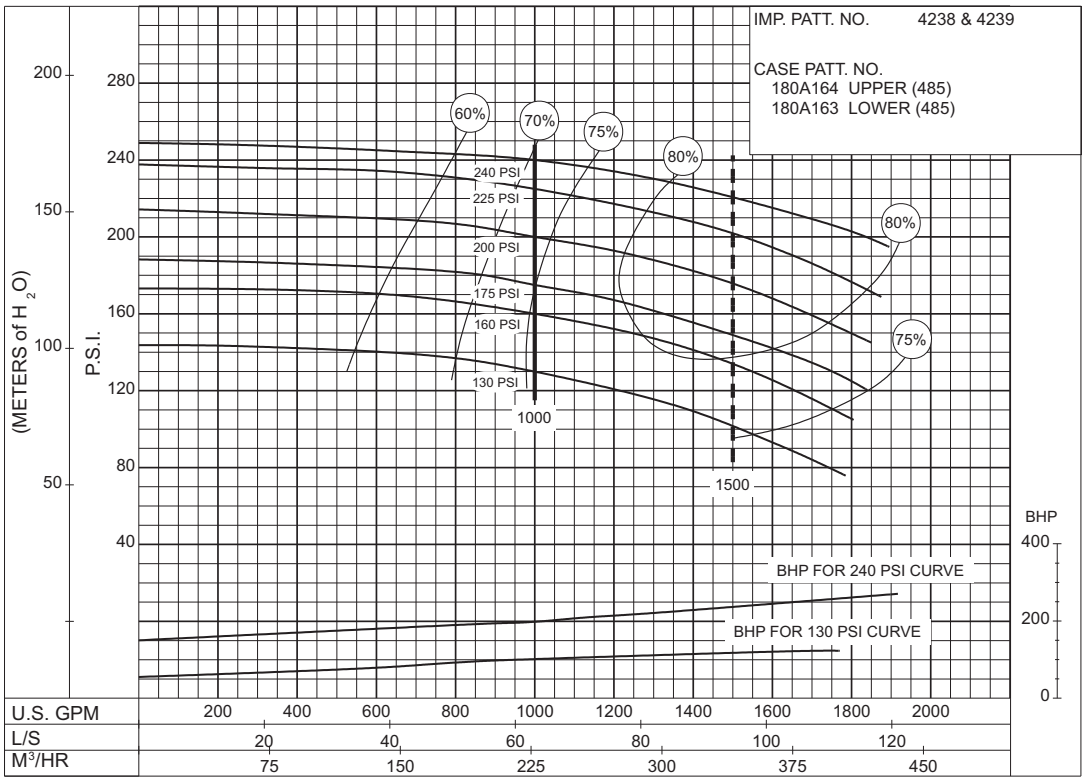
1000 G.P.M. 912 SERIES

ELECTRIC MOTOR DRIVE

Supersedes Section 912 Page 419.1
Dated November 2005

130 to 240 P.S.I.

SIZE : 6”1922AF **MODEL: 1900** **IMPELLER : Enclosed** **R. P. M. : 1770**



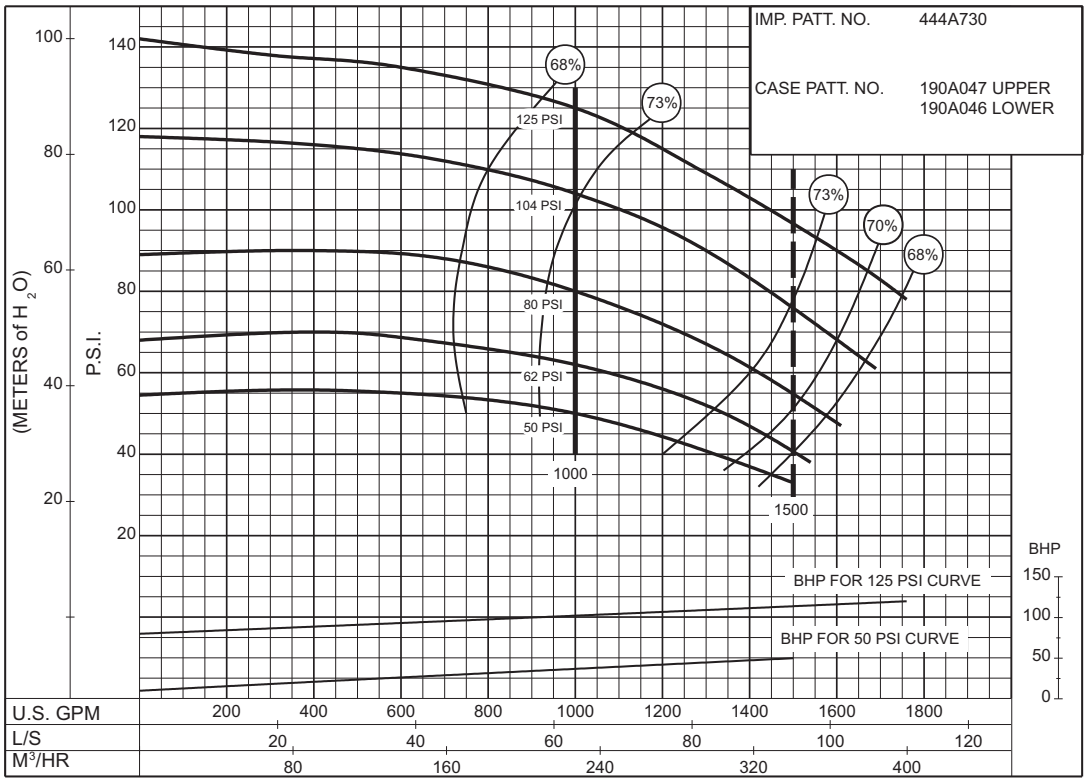
PC-153363

1000 G.P.M. 912 SERIES

ELECTRIC MOTOR DRIVE

50 to 125 P.S.I.

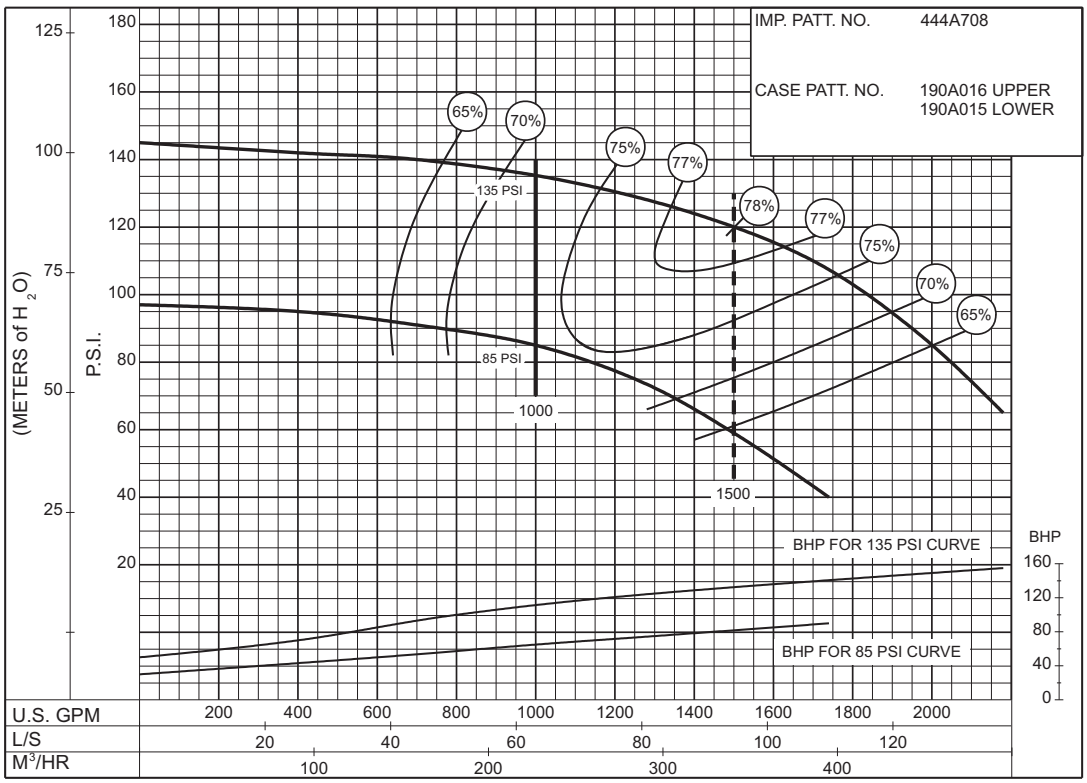
SIZE : 5”5824F **MODEL: 5800** **IMPELLER : Enclosed** **R. P. M. : 1770**



PC-168448

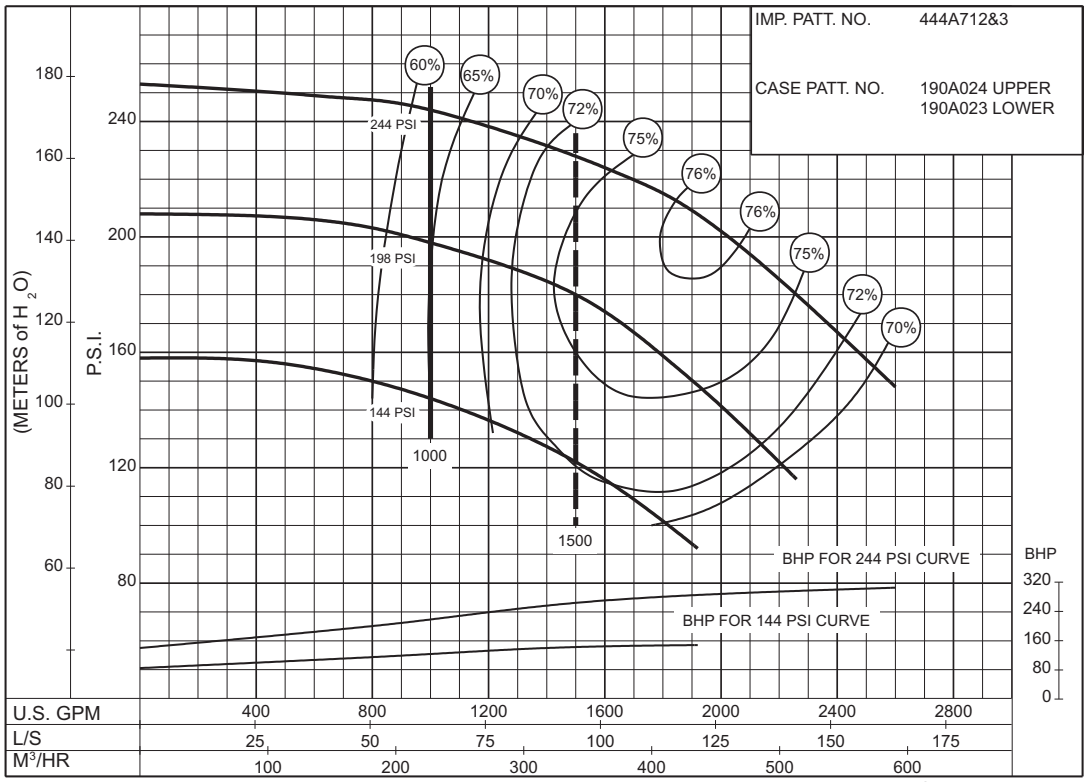
85 to 135 P.S.I.

SIZE : 5”2824AF **MODEL: 2800** **IMPELLER : Enclosed** **R. P. M. : 1770**



PC-168449

SIZE : 6"5922F **MODEL: 5900** **IMPELLER : Enclosed** **R. P. M. : 1770**



PC-168450

144 to 244 P.S.I.

APPENDIX J
INSPECTION TESTING AND MAINTENANCE

NFPA 25
Inspection, Testing, and Maintenance of Water Based Systems (2011)
Chapter 5 - Sprinkler Systems

Chapter 5 Sprinkler Systems

5.1 General.

5.1.1 Minimum Requirements.

5.1.1.1 This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of sprinkler systems.

5.1.1.2 Table 5.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

5.1.2 Valves and Connections. Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.

5.1.3 Obstruction Investigations. The procedures outlined in Chapter 14 shall be followed where there is a need to conduct an obstruction investigation.

Table 5.1.1.2 Summary of Sprinkler System Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Gauges (dry, preaction, and deluge systems)	Weekly/monthly	5.2.4.2, 5.2.4.3, 5.2.4.4
Control valves		Table 13.1
Waterflow alarm devices	Quarterly	5.2.5
Valve supervisory alarm devices	Quarterly	5.2.5
Supervisory signal devices (except valve supervisory switches)	Quarterly	5.2.5
Gauges (wet pipe systems)	Monthly	5.2.4.1
Hydraulic nameplate	Quarterly	5.2.6
Buildings	Annually (prior to freezing weather)	4.1.1.1
Hanger/seismic bracing	Annually	5.2.3
Pipe and fittings	Annually	5.2.2
Sprinklers	Annually	5.2.1
Spare sprinklers	Annually	5.2.1.4
Information sign	Annually	5.2.6.1
Fire department connections		Table 13.1
Valves (all types)		Table 13.1
Obstruction, internal inspection of piping	5 years	14.2
Test		
Waterflow alarm devices		
Mechanical devices	Quarterly	5.3.3.1
Vane and pressure switch type devices	Semiannually	5.3.3.2
Valves supervisory alarm devices		Table 13.1
Supervisory signal devices (except valve supervisory switches)		Table 13.1
Main drain		Table 13.1
Antifreeze solution	Annually	5.3.4
Gauges	5 years	5.3.2
Sprinklers — extra-high temperature	5 years	5.3.1.1.1.4
Sprinklers — fast-response	At 20 years and every 10 years thereafter	5.3.1.1.1.3
Sprinklers	At 50 years and every 10 years thereafter	5.3.1.1.1
Sprinklers	At 75 years and every 5 years thereafter	5.3.1.1.1.5
Sprinklers — dry	At 10 years and every 10 years thereafter	5.3.1.1.1.6
Maintenance		
Valves (all types)		Table 13.1
Low-point drains (dry pipe system)		13.4.4.3.2
Sprinklers and automatic spray nozzles protecting commercial cooking equipment and ventilation systems	Annually	5.4.1.9
Investigation		
Obstruction		14.3

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Chapter 6 - Standpipes and Hose Systems

5.5.2 A main drain test shall be required if the system control or other upstream valve was operated in accordance with 13.3.3.4.

5.5.3 Where the original installation standard is different from the cited standard, the use of the appropriate installing standard shall be permitted.

5.5.4 These actions shall not require a design review, which is outside the scope of this standard.

Chapter 6 Standpipe and Hose Systems

6.1 General.

6.1.1 Minimum Requirements.

6.1.1.1 This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of standpipe and hose systems.

6.1.1.2 Table 6.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

6.1.2 Table 6.1.2 shall be used for the inspection, testing, and maintenance of all classes of standpipe and hose systems.

6.1.3 Checkpoints and corrective actions outlined in Table 6.1.2 shall be followed to determine that components are free of corrosion, foreign material, physical damage, tampering, or other conditions that adversely affect system operation.

6.1.4 Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.

6.1.5 Obstruction Investigations. The procedures outlined in Chapter 14 shall be followed where there is a need to conduct an obstruction investigation.

6.1.6 Where the inspection, testing, and maintenance of standpipe and hose systems results or involves a system that is out of service, the impairment procedures outlined in Chapter 15 shall be followed.

6.1.7 Where approved by the authority having jurisdiction, existing hose shall be permitted to be removed and shall not be recorded as a deficiency.

6.1.8 Notification to Supervisory Service. To avoid false alarms where a supervisory service is provided, the alarm receiving facility shall be notified by the property owner or designated representative as follows:

(1) Before conducting any test or procedure that could result in the activation of an alarm
(2) After such tests or procedures are concluded

6.2 Inspection.

6.2.1 Components of standpipe and hose systems shall be visually inspected annually or as specified in Table 6.1.1.2.

Table 6.1.1.2 Summary of Standpipe and Hose Systems Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Control valves		Table 13.1
Pressure regulating devices		Table 13.1
Piping	Annually	6.2.1
Hose connections		Table 13.1
Cabinet	Annually	NFPA 1962
Gauges	Weekly	6.2.2
Hose	Annually	NFPA 1962
Hose storage device	Annually	NFPA 1962
Hose nozzle	Annually and after each use	NFPA 1962
Hydraulic design information sign	Annually	6.2.3
Test		
Waterflow alarm devices		Table 13.1
Valve supervisory alarm devices		Table 13.1
Supervisory signal devices (except valve supervisory switches)		Table 13.1
Hose storage device	Annually	NFPA 1962
Hose	5 years/3 years	NFPA 1962
Pressure control valve		Table 13.1
Pressure reducing valve		Table 13.1
Hydrostatic test	5 years	6.3.2
Flow test	5 years	6.3.1
Main drain test		Table 13.1
Maintenance		
Hose connections	Annually	Table 6.1.2
Valves (all types)	Annually/as needed	Table 13.1

Table 6.1.2 Standpipe and Hose Systems

Component/Checkpoint	Corrective Action
Hose Connections	
Cap missing	Replace
Fire hose connection damaged	Repair
Valve handles missing	Replace
Cap gaskets missing or deteriorated	Replace
Valve leaking	Close or repair
Visible obstructions	Remove
Restricting device missing	Replace
Manual, semiautomatic, or dry standpipe — valve does not operate smoothly	Lubricate or repair
Piping	
Damaged piping	Repair
Control valves damaged	Repair or replace
Missing or damaged pipe support device	Repair or replace
Damaged supervisory devices	Repair or replace
Hose	
Inspect	Remove and inspect the hose, including gaskets, and rerack or rereel at intervals in accordance with NFPA 1962, *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose*
Mildew, cuts, abrasions, and deterioration evident	Replace with listed lined, jacketed hose
Coupling damaged	Replace or repair
Gaskets missing or deteriorated	Replace
Incompatible threads on coupling	Replace or provide thread adapter
Hose not connected to hose rack nipple or valve	Connect
Hose test outdated	Retest or replace in accordance with NFPA 1962
Hose Nozzle	
Hose nozzle missing	Replace with listed nozzle
Gasket missing or deteriorated	Replace
Obstructions	Remove
Nozzle does not operate smoothly	Repair or replace
Hose Storage Device	
Difficult to operate	Repair or replace
Damaged	Repair or replace
Obstruction	Remove
Hose improperly racked or rolled	Remove
Nozzle clip in place and nozzle correctly contained?	Replace if necessary
If enclosed in cabinet, will hose rack swing out at least 90 degrees?	Repair or remove any obstructions
Cabinet	
Check overall condition for corroded or damaged parts	Repair or replace parts; replace entire cabinet if necessary
Difficult to open	Repair
Cabinet door will not open fully	Repair or move obstructions
Door glazing cracked or broken	Replace
If cabinet is break-glass type, is lock functioning properly?	Repair or replace
Glass break device missing or not attached	Replace or attach
Not properly identified as containing fire equipment	Provide identification
Visible obstructions	Remove
All valves, hose, nozzles, fire extinguisher, etc., easily accessible	Remove any material not related

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Chapter 8 - Fire Pumps

Table 8.1.2 Alternative Fire Pump Inspection, Testing, and Maintenance Procedures

Complete as Applicable	Visual Inspection	Check	Change	Clean	Test	Frequency
Pump System						
Lubricate pump bearings			X			Annually
Check pump shaft end play		X				Annually
Check accuracy of pressure gauges and sensors		X	X			Annually (change or recalibrate when 5% out of calibration)
Check pump coupling alignment		X				Annually
Wet pit suction screens		X		X		After each pump operation
Mechanical Transmission						
Lubricate coupling			X			Annually
Lubricate right-angle gear drive			X			Annually
Electrical System						
Exercise isolating switch and circuit breaker					X	Monthly
Trip circuit breaker (if mechanism provided)					X	Annually
Operate manual starting means (electrical)					X	Semiannually
Inspect and operate emergency manual starting means (without power)	X				X	Annually
Tighten electrical connections as necessary		X				Annually
Lubricate mechanical moving parts (excluding starters and relays)		X				Annually
Calibrate pressure switch settings		X				Annually
Grease motor bearings			X			Annually
Voltmeter and ammeter for accuracy (5%)		X				Annually
Any corrosion on printed circuit boards (PCBs)	X					Annually
Any cracked cable/wire insulation	X					Annually
Any leaks in plumbing parts	X					Annually
Any signs of water on electrical parts	X					Annually
Diesel Engine System						
Fuel						
Tank level	X	X				Weekly
Tank float switch	X				X	Weekly
Solenoid valve operation	X				X	Weekly
Strainer, filter, or dirt leg, or combination thereof				X		Quarterly
Water and foreign material in tank				X		Annually
Water in system		X		X		Weekly
Flexible hoses and connectors	X					Weekly
Tank vents and overflow piping unobstructed		X			X	Annually
Piping	X					Annually
Lubrication system						
Oil level	X	X				Weekly
Oil change			X			50 hours or annually
Oil filter(s)			X			50 hours or annually
Lube oil heater		X				Weekly
Crankcase breather	X		X	X		Quarterly
Cooling system						
Level	X	X				Weekly
Antifreeze protection level					X	Semiannually
Antifreeze		X				Annually
Adequate cooling water to heat exchanger		X				Weekly
Rod out heat exchanger				X		Annually
Water pump(s)	X					Weekly
Condition of flexible hoses and connections	X	X				Weekly
Jacket water heater		X				Weekly
Inspect duct work, clean louvers (combustion air)	X	X	X			Annually
Water strainer				X		Quarterly

Table 8.1.2 *Continued*

Complete as Applicable	Visual Inspection	Check	Change	Clean	Test	Frequency
Exhaust system						
Leakage	X	X				Weekly
Drain condensate trap		X				Weekly
Insulation and fire hazards	X					Quarterly
Excessive back pressure					X	Annually
Exhaust system hangers and supports	X					Annually
Flexible exhaust section	X					Semiannually
Battery system						
Electrolyte level		X				Weekly
Terminals clean and tight	X	X				Quarterly
Case exterior clean and dry	X	X				Monthly
Specific gravity or state of charge					X	Monthly
Charger and charge rate	X					Monthly
Equalize charge		X				Monthly
Clean terminals				X		Annually
Cranking voltage exceeds 9 volts on a 12 volt system or 18 volts on a 24 volt system		X				Weekly
Electrical system						
General inspection	X					Weekly
Tighten control and power wiring connections		X				Annually
Wire chafing where subject to movement	X	X				Quarterly
Operation of safeties and alarms		X			X	Semiannually
Boxes, panels, and cabinets				X		Semiannually
Circuit breakers or fuses	X	X				Monthly
Circuit breakers or fuses			X			Biennially
Voltmeter and ammeter for accuracy (5%)		X				Annually
Any corrosion on printed circuit boards (PCBs)	X					Annually
Any cracked cable/wire insulation	X					Annually
Any leaks in plumbing parts	X					Annually
Any signs of water on electrical parts	X					Annually

Table 8.1.1.2 Summary of Fire Pump Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Pump house, heating ventilating louvers	Weekly	8.2.2(1)
Fire pump system	Weekly	8.2.2
Test		
Pump operation		
No-flow condition		8.3.1
Diesel engine driven fire pump	Weekly	
Electric motor driven fire pump	Monthly	
Flow condition	Annually	8.3.3
Fire pump alarm signals	Annually	8.3.3.5
Maintenance		
Hydraulic	Annually	8.5
Mechanical transmission	Annually	8.5
Electrical system	Varies	8.5
Controller, various components	Varies	8.5
Motor	Annually	8.5
Diesel engine system, various components	Varies	8.5

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Inspection, Testing, and Maintenance of Water Based Systems (2011)
Chapter 13 - Valves, Valve Components, and Trim

Table 13.1.1.2 Summary of Valves, Valve Components, and Trim Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Control Valves		
Sealed	Weekly	13.3.2.1
Locked	Monthly	13.3.2.1.1
Tamper switches	Monthly	13.3.2.1.1
Alarm Valves		
Exterior	Monthly	13.4.1.1
Interior	5 years	13.4.1.2
Strainers, filters, orifices	5 years	13.4.1.2
Check Valves		
Interior	5 years	13.4.2.1
Preaction/Deluge Valves		
Enclosure (during cold weather)	Daily/weekly	13.4.3.1
Exterior	Monthly	13.4.3.1.6
Interior	Annually/5 years	13.4.3.1.7
Strainers, filters, orifices	5 years	13.4.3.1.8
Dry Pipe Valves/ Quick-Opening Devices		
Gauges	Weekly/monthly	13.4.4.1.2.4, 13.4.4.1.2.5
Enclosure (during cold weather)	Daily/weekly	13.4.4.1.1
Exterior	Monthly	13.4.4.1.4
Interior	Annually	13.4.4.1.5
Strainers, filters, orifices	5 years	13.4.4.1.6
Pressure Reducing and Relief Valves		
Sprinkler systems	Quarterly	13.5.1.1
Hose connections	Annually	13.5.2.1
Hose racks	Annually	13.5.3.1
Fire Pumps		
Casing relief valves	Weekly	13.5.7.1, 13.5.7.1.1
Pressure relief valves	Weekly	13.5.7.2, 13.5.7.2.1
Backflow Prevention Assemblies		
Reduced pressure	Weekly/monthly	13.6.1
Reduced pressure detectors	Weekly/monthly	13.6.1
Fire Department Connections	Quarterly	13.7.1
Testing		
Main Drains	Annually/quarterly	13.2.5, 13.2.5.1, 13.3.3.4
Waterflow Alarms	Quarterly/semiannually	13.2.6
Control Valves		
Position	Annually	13.3.3.1
Operation	Annually	13.3.3.1
Supervisory	Semiannually	13.3.3.5
Preaction/Deluge Valves		
Priming water	Quarterly	13.4.3.2.1
Low air pressure alarms	Quarterly/annually	13.4.3.2.13, 13.4.3.2.14
Full flow	Annually	13.4.3.2.2

Table 13.1.1.2 *Continued*

Item	Frequency	Reference
Dry Pipe Valves/ Quick-Opening Devices		
Priming water	Quarterly	13.4.4.2.1
Low air pressure alarm	Quarterly	13.4.4.2.6
Quick-opening devices	Quarterly	13.4.4.2.4
Trip test	Annually	13.4.4.2.2
Full flow trip test	3 years	13.4.4.2.2.2
Pressure Reducing and Relief Valves		
Sprinkler systems	5 years	13.5.1.2
Circulation relief	Annually	13.5.7.1.2
Pressure relief valves	Annually	13.5.7.2.2
Hose connections	5 years	13.5.2.2
Hose racks	5 years	13.5.3.2
Backflow Prevention Assemblies	Annually	13.6.2
Maintenance		
Control Valves	Annually	13.3.4
Preaction/Deluge Valves	Annually	13.4.3.3.2
Dry Pipe Valves/ Quick-Opening Devices	Annually	13.4.4.3

13.3.3.2.1 This test shall be conducted every time the valve is closed.

13.3.3.3 Post indicator and outside screw and yoke valves shall be backed a one-quarter turn from the fully open position to prevent jamming.

13.3.3.4 A main drain test shall be conducted any time the control valve is closed and reopened at system riser.

13.3.3.5* Supervisory Switches.

13.3.3.5.1 Valve supervisory switches shall be tested semiannually.

13.3.3.5.2 A distinctive signal shall indicate movement from the valve's normal position during either the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position.

13.3.3.5.3 The signal shall not be restored at any valve position except the normal position.

13.3.4 Maintenance.

13.3.4.1 The operating stems of outside screw and yoke valves shall be lubricated annually.

13.3.4.2 The valve then shall be completely closed and reopened to test its operation and distribute the lubricant.

13.4 System Valves.

13.4.1 Inspection of Alarm Valves. Alarm valves shall be inspected as described in 13.4.1.1 and 13.4.1.2.

13.4.1.1* Alarm valves and system riser check valves shall be externally inspected monthly and shall verify the following:

(1) The gauges indicate normal supply water pressure is being maintained.
(2) The valve is free of physical damage.
(3) All valves are in the appropriate open or closed position.
(4) The retarding chamber or alarm drains are not leaking.

13.4.1.2* Alarm valves and their associated strainers, filters, and restriction orifices shall be inspected internally every 5 years unless tests indicate a greater frequency is necessary.

13.4.1.3 Maintenance.

13.4.1.3.1 Internal components shall be cleaned/repaired as necessary in accordance with the manufacturer's instructions.

13.4.1.3.2 The system shall be returned to service in accordance with the manufacturer's instructions.

13.4.2 Check Valves.

13.4.2.1 Inspection. Valves shall be inspected internally every 5 years to verify that all components operate correctly, move freely, and are in good condition.

13.4.2.2 Maintenance. Internal components shall be cleaned, repaired, or replaced as necessary in accordance with the manufacturer's instructions.

13.4.3 Preaction Valves and Deluge Valves.

13.4.3.1 Inspection.

13.4.3.1.1 Valve enclosure heating equipment for preaction and deluge valves subject to freezing shall be inspected daily during cold weather for its ability to maintain a minimum temperature of at least 40°F (4.4°C).

13.4.3.1.1.1 Valve enclosures equipped with low temperature alarms shall be inspected weekly.

13.4.3.1.2 Low temperature alarms, if installed in valve enclosures, shall be inspected annually at the beginning of the heating season.

13.4.3.1.3 Gauges shall be inspected weekly.

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Chapter 14

Table 14.3.1 Visual Inspection

	Component	Initial Acceptance	Periodic Frequency	Method	Reference
1.	All equipment	X	Annual	Ensure there are no changes that affect equipment performance. Inspect for building modifications, occupancy changes, changes in environmental conditions, device location, physical obstructions, device orientation, physical damage, and degree of cleanliness.	14.3.4
2.	Control equipment:				
	(a) Fire alarm systems monitored for alarm, supervisory, and trouble signals			Verify a system normal condition.	
	(1) Fuses	X	Annual		
	(2) Interfaced equipment	X	Annual		
	(3) Lamps and LEDs	X	Annual		
	(4) Primary (main) power supply	X	Annual		
	(5) Trouble signals	X	Semiannual		
	(b) Fire alarm systems unmonitored for alarm, supervisory, and trouble signals			Verify a system normal condition.	
	(1) Fuses	X	Weekly		
	(2) Interfaced equipment	X	Weekly		
	(3) Lamps and LEDs	X	Weekly		
	(4) Primary (main) power supply	X	Weekly		
	(5) Trouble signals	X	Weekly		
3.	Reserved				
4.	Supervising station alarm systems — transmitters			Verify location, physical condition, and a system normal condition.	
	(a) Digital alarm communicator transmitter (DACT)	X	Annual		
	(b) Digital alarm radio transmitter (DART)	X	Annual		
	(c) McCulloh	X	Annual		
	(d) Radio alarm transmitter (RAT)	X	Annual		
	(e) All other types of communicators	X	Annual		
5.	In-building fire emergency voice/alarm communications equipment	X	Semiannual	Verify location and condition.	
6.	Reserved				
7.	Reserved				
8.	Reserved				
9.	Batteries			Inspect for corrosion or leakage. Verify tightness of connections. Verify marking of the month/year of manufacture (all types).	10.6.10
	(a) Lead-acid	X	Monthly	Visually inspect electrolyte level.	
	(b) Nickel-cadmium	X	Semiannual		
	(c) Primary (dry cell)	X	Monthly		
	(d) Sealed lead-acid	X	Semiannual		
10.	Reserved				

(continues)

Table 14.3.1 *Continued*

	Component	Initial Acceptance	Periodic Frequency	Method	Reference
11.	Remote annunciators	X	Semiannual	Verify location and condition.	
12.	Notification appliance circuit power extenders	X	Annual	Verify proper fuse ratings, if any. Verify that lamps and LEDs indicate normal operating status of the equipment.	10.6
13.	Remote power supplies	X	Annual	Verify proper fuse ratings, if any. Verify that lamps and LEDs indicate normal operating status of the equipment.	10.6
14.	Transient suppressors	X	Semiannual	Verify location and condition.	
15.	Reserved				
16.	Fiber-optic cable connections	X	Annual	Verify location and condition.	
17.	Initiating devices			Verify location and condition (all devices).	
	(a) Air sampling				
	(1) General	X	Semiannual	Verify that in-line filters, if any, are clean.	17.7.3.6
	(2) Sampling system piping and sampling ports	X		Verify that sampling system piping and fittings are installed properly, appear airtight, and are permanently fixed. Confirm that sampling pipe is conspicuously identified. Verify that sample ports or points are not obstructed.	17.7.3.6
	(b) Duct detectors				
	(1) General	X	Semiannual	Verify that detector is rigidly mounted. Confirm that no penetrations in a return air duct exist in the vicinity of the detector. Confirm the detector is installed so as to sample the airstream at the proper location in the duct.	17.7.5.5
	(2) Sampling tube	X		Verify proper orientation. Confirm the sampling tube protrudes into the duct in accordance with system design.	17.7.5.5
	(c) Electromechanical releasing devices	X	Semiannual		
	(d) Fire extinguishing system(s) or suppression system(s) switches	X	Semiannual		
	(e) Manual fire alarm boxes	X	Semiannual		
	(f) Heat detectors	X	Semiannual		
	(g) Radiant energy fire detectors	X	Quarterly	Verify no point requiring detection is obstructed or outside the detector's field of view.	17.8
	(h) Video image smoke and fire detectors	X	Quarterly	Verify no point requiring detection is obstructed or outside the detector's field of view.	17.7.7; 17.11.5
	(i) Smoke detectors (excluding one- and two-family dwellings)	X	Semiannual		
	(j) Projected beam smoke detectors	X	Semiannual	Verify beam path is unobstructed.	
	(k) Supervisory signal devices	X	Quarterly		
	(l) Waterflow devices	X	Quarterly		
18.	Reserved				

Table 14.3.1 *Continued*

	Component	Initial Acceptance	Periodic Frequency	Method	Reference
19.	Combination systems			Verify location and condition (all types).	
	(a) Fire extinguisher electronic monitoring device/systems	X	Semiannual		
	(b) Carbon monoxide detectors/systems	X	Semiannual		
20.	Fire alarm control interface and emergency control function interface	X	Semiannual	Verify location and condition.	
21.	Guard's tour equipment	X	Semiannual	Verify location and condition.	
22.	Notification appliances			Verify location and condition (all appliances).	
	(a) Audible appliances	X	Semiannual		
	(b) Audible textual notification appliances	X	Semiannual		
	(c) Visible appliances				
	(1) General	X	Semiannual		18.5.5
	(2) Candela rating	X		Verify that the candela rating marking agrees with the approved drawings.	18.5.5
23.	Exit marking audible notification appliances	X	Semiannual	Verify location and condition.	
24.	Reserved				
25.	Area of refuge two-way communication system	X	Annual	Verify location and condition.	
26.	Reserved				
27.	Supervising station alarm systems — receivers				
	(a) Signal receipt	X	Daily	Verify receipt of signal.	
	(b) Receivers	X	Annual	Verify location and normal condition.	
28.	Public emergency alarm reporting system transmission equipment			Verify location and condition.	
	(a) Publicly accessible alarm box	X	Semiannual		
	(b) Auxiliary box	X	Annual		
	(c) Master box				
	(1) Manual operation	X	Semiannual		
	(2) Auxiliary operation	X	Annual		
29.	Reserved				
30.	Mass notification system				
	(a) Monitored for integrity			Verify a system normal condition.	
	(1) Control equipment				
	(i) Fuses	X	Annual		
	(ii) Interfaces	X	Annual		
	(iii) Lamps/LED	X	Annual		
	(iv) Primary (main) power supply	X	Annual		
	(2) Secondary power batteries	X	Annual		
	(3) Initiating devices	X	Annual		
	(4) Notification appliances	X	Annual		

(continues)

Table 14.3.1 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method	Reference
30. Mass notification system *(continued)*				
(b) Not monitored for integrity; installed prior to adoption of the 2010 edition			Verify a system normal condition.	
(1) Control equipment				
(i) Fuses	X	Semiannual		
(ii) Interfaces	X	Semiannual		
(iii) Lamps/LED	X	Semiannual		
(iv) Primary (main) power supply	X	Semiannual		
(2) Secondary power batteries	X	Semiannual		
(3) Initiating devices	X	Semiannual		
(4) Notification appliances	X	Semiannual		
(c) Antenna	X	Annual	Verify location and condition.	
(d) Transceivers	X	Annual	Verify location and condition.	

14.3.2 Devices or equipment that is inaccessible for safety considerations (e.g., continuous process operations, energized electrical equipment, radiation, and excessive height) shall be permitted to be inspected during scheduled shutdowns if approved by the authority having jurisdiction.

14.3.3 Extended intervals shall not exceed 18 months.

14.3.4 The visual inspection shall be made to ensure that there are no changes that affect equipment performance.

14.4 Testing.

14.4.1 Initial Acceptance Testing.

14.4.1.1 All new systems shall be inspected and tested in accordance with the requirements of Chapter 14.

14.4.1.2 The authority having jurisdiction shall be notified prior to the initial acceptance test.

14.4.2* Reacceptance Testing.

14.4.2.1 When an initiating device, notification appliance, or control relay is added, it shall be functionally tested.

14.4.2.2 When an initiating device, notification appliance, or control relay is deleted, another device, appliance, or control relay on the circuit shall be operated.

14.4.2.3 When modifications or repairs to control equipment hardware are made, the control equipment shall be tested in accordance with Table 14.4.3.2, items 1(a) and 1(d).

14.4.2.4 When changes are made to site-specific software, the following shall apply:

(1) All functions known to be affected by the change, or identified by a means that indicates changes, shall be 100 percent tested.
(2) In addition, 10 percent of initiating devices that are not directly affected by the change, up to a maximum of 50 devices, also shall be tested and correct system operation shall be verified.
(3) A revised record of completion in accordance with 7.5.6 shall be prepared to reflect these changes.

14.4.2.5 Changes to the system executive software shall require a 10 percent functional test of the system, including a test of at least one device on each input and output circuit to verify critical system functions such as notification appliances, control functions, and off-premises reporting.

14.4.3* Test Methods.

14.4.3.1* At the request of the authority having jurisdiction, the central station facility installation shall be inspected for complete information regarding the central station system, including specifications, wiring diagrams, and floor plans that have been submitted for approval prior to installation of equipment and wiring.

14.4.3.2* Systems and associated equipment shall be tested according to Table 14.4.3.2.

Table 14.4.3.2 was revised by tentative interim amendments (TIAs). See page 1.

Table 14.4.3.2 Testing

Component	Initial Acceptance	Periodic Frequency	Method
1. All equipment	X		See Table 14.3.1.
2. Control equipment and transponder			
(a) Functions	X	Annually	Verify correct receipt of alarm, supervisory, and trouble signals (inputs); operation of evacuation signals and auxiliary functions (outputs); circuit supervision, including detection of open circuits and ground faults; and power supply supervision for detection of loss of ac power and disconnection of secondary batteries.
(b) Fuses	X	Annually	Verify rating and supervision.
(c) Interfaced equipment	X	Annually	Verify integrity of single or multiple circuits providing interface between two or more control units. Test interfaced equipment connections by operating or simulating operation of the equipment being supervised. Verify signals required to be transmitted at the control unit.
(d) Lamps and LEDs	X	Annually	Illuminate lamps and LEDs.
(e) Primary (main) power supply	X	Annually	Disconnect and test all secondary (standby) power under maximum load, including all alarm appliances requiring simultaneous operation. Reconnect all secondary (standby) power at end of test. Test redundant power supplies separately.
3. Fire alarm control unit trouble signals			
(a) Audible and visual	X	Annually	Verify operation of control unit trouble signals. Verify ring-back feature for systems using a trouble-silencing switch that requires resetting.
(b) Disconnect switches	X	Annually	If control unit has disconnect or isolating switches, verify performance of intended function of each switch. Verify receipt of trouble signal when a supervised function is disconnected.
(c) Ground-fault monitoring circuit	X	Annually	If the system has a ground detection feature, verify the occurrence of ground-fault indication whenever any installation conductor is grounded.
(d) Transmission of signals to off-premises location	X	Annually	Actuate an initiating device and verify receipt of alarm signal at the off-premises location. Create a trouble condition and verify receipt of a trouble signal at the off-premises location. Actuate a supervisory device and verify receipt of a supervisory signal at the off-premises location. If a transmission carrier is capable of operation under a single- or multiple-fault condition, activate an initiating device during such fault condition and verify receipt of an alarm signal and a trouble signal at the off-premises location.
4. Supervising station alarm systems — transmission Equipment			
(a) All equipment	X	Annually	[a]Test all system functions and features in accordance with the equipment manufacturer's published instructions for correct operation in conformance with the applicable sections of Chapter 26. Except for DACT, actuate initiating device and verify receipt of the correct initiating device signal at the supervising station within 90 seconds. Upon completion of the test, restore the system to its functional operating condition. If test jacks are used, conduct the first and last tests without the use of the test jack.
(b) Digital alarm communicator transmitter (DACT)	X	Annually	Except for DACTs installed prior to adoption of the 2013 edition of NFPA 72 that are connected to a telephone line (number) that is also supervised for adverse conditions by a derived local channel, ensure connection of the DACT to two separate means of transmission. Test DACT for line seizure capability by initiating a signal while using the telephone line (primary line for DACTs using two telephone lines) for a telephone call. Ensure that the call is interrupted and that the communicator connects to the digital alarm receiver. Verify receipt of the correct signal at the supervising station. Verify each transmission attempt is completed within 90 seconds from going off-hook to on-hook.

(continues)

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
4. Supervising station alarm systems — transmission Equipment			
(b) Digital alarm communicator transmitter (DACT) *(continued)*			Disconnect the telephone line (primary line for DACTs using two telephone lines) from the DACT. Verify indication of the DACT trouble signal occurs at the premises fire alarm control unit within 4 minutes of detection of the fault. Verify receipt of the telephone line trouble signal at the supervising station. Restore the telephone line (primary line for DACTs using two telephone lines), reset the fire alarm control unit, and verify that the telephone line fault trouble signal returns to normal. Verify that the supervising station receives the restoral signal from the DACT. Disconnect the secondary means of transmission from the DACT. Verify indication of the DACT trouble signal occurs at the premises fire alarm control unit within 4 minutes of detection of the fault. Verify receipt of the secondarey means trouble signal at the supervising station. Restore the secondary means of transmission, reset the fire alarm control unit, and verify that the trouble signal returns to normal. Verify that the supervising station receives the restoral signal from the secondary transmitter. Cause the DACT to transmit a signal to the DACR while a fault in the telephone line (number) (primary line for DACTs using two telephone lines) is simulated. Verify utilization of the secondary communication path by the DACT to complete the transmission to the DACR.
(c) Digital alarm radio transmitter (DART)	X	Annually	Disconnect the primary telephone line. Verify transmission of a trouble signal to the supervising station by the DART occurs within 4 minutes.
(d) McCulloh transmitter	X	Annually	Actuate initiating device. Verify production of not less than three complete rounds of not less than three signal impulses each by the McCulloh transmitter. If end-to-end metallic continuity is present and with a balanced circuit, cause each of the following four transmission channel fault conditions in turn, and verify receipt of correct signals at the supervising station: (1) Open (2) Ground (3) Wire-to-wire short (4) Open and ground If end-to-end metallic continuity is not present and with a properly balanced circuit, cause each of the following three transmission channel fault conditions in turn, and verify receipt of correct signals at the supervising station: (1) Open (2) Ground (3) Wire-to-wire short
(e) Radio alarm transmitter (RAT)	X	Annually	Cause a fault between elements of the transmitting equipment. Verify indication of the fault at the protected premises, or transmission of trouble signal to the supervising station.
(f) Performance-based technologies	X	Annually	Perform tests to ensure the monitoring of integrity of the transmission technology and technology path. Where a single communications path is used, disconnect the communication path. Manually initiate an alarm signal transmission or allow the check-in (handshake) signal to be transmitted automatically.[b] Verify the premises unit annunciates the failure within 200 seconds of the transmission failure. Restore the communication path. Where multiple communication paths are used, disconnect both communication paths. Manually initiate an alarm signal transmission. Verify the premises control unit annunciates the failure within 200 seconds of the transmission failure. Restore both communication paths.
5. Emergency communications equipment			
(a) Amplifier/tone generators	X	Annually	Verify correct switching and operation of backup equipment.
(b) Call-in signal silence	X	Annually	Operate/function and verify receipt of correct visual and audible signals at control unit.
(c) Off-hook indicator (ring down)	X	Annually	Install phone set or remove phone from hook and verify receipt of signal at control unit.
(d) Phone jacks	X	Annually	Visually inspect phone jack and initiate communications path through jack.

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
(e) Phone set	X	Annually	Activate each phone set and verify correct operation.
(f) System performance	X	Annually	Operate the system with a minimum of any five handsets simultaneously. Verify voice quality and clarity.
6. Engine-driven generator	X	Monthly	If an engine-driven generator dedicated to the system is used as a required power source, verify operation of the generator in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems,* by the building owner.
7. Secondary (standby) power supply[c]	X	Annually	Disconnect all primary (main) power supplies and verify the occurrence of required trouble indication for loss of primary power. Measure or verify the system's standby and alarm current demand and verify the ability of batteries to meet standby and alarm requirements using manufacturer's data. Operate general alarm systems a minimum of 5 minutes and emergency voice communications systems for a minimum of 15 minutes. Reconnect primary (main) power supply at end of test.
8. Uninterruptible power supply (UPS)	X	Annually	If a UPS system dedicated to the system is used as a required power source, verify by the building owner operation of the UPS system in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems.*
9. Battery tests			Prior to conducting any battery testing, verify by the person conducting the test, that all system software stored in volatile memory is protected from loss.
(a) Lead-acid type			
(1) Battery replacement	X	Annually	Replace batteries in accordance with the recommendations of the alarm equipment manufacturer or when the recharged battery voltage or current falls below the manufacturer's recommendations.
(2) Charger test	X	Annually	With the batteries fully charged and connected to the charger, measure the voltage across the batteries with a voltmeter. Verify the voltage is 2.30 volts per cell ±0.02 volts at 77°F (25°C) or as specified by the equipment manufacturer.
(3) Discharge test	X	Annually	With the battery charger disconnected, load test the batteries following the manufacturer's recommendations. Verify the voltage level does not fall below the levels specified. Load testing can be by means of an artificial load equal to the full fire alarm load connected to the battery.
(4) Load voltage test	X	Semiannually	With the battery charger disconnected, load test the batteries following the manufacturer's recommendations. Verify the voltage level does not fall below the levels specified. Load testing can be by means of an artificial load equal to the full fire alarm load connected to the battery. Verify the battery does not fall below 2.05 volts per cell under load.
(5) Specific gravity	X	Semiannually	Measure as required the specific gravity of the liquid in the pilot cell or all of the cells. Verify the specific gravity is within the range specified by the manufacturer. Although the specified specific gravity varies from manufacturer to manufacturer, a range of 1.205–1.220 is typical for regular lead-acid batteries, while 1.240–1.260 is typical for high-performance batteries. Do not use a hydrometer that shows only a pass or fail condition of the battery and does not indicate the specific gravity, because such a reading does not give a true indication of the battery condition.
(b) Nickel-cadmium type			
(1) Battery replacement	X	Annually	Replace batteries in accordance with the recommendations of the alarm equipment manufacturer or when the recharged battery voltage or current falls below the manufacturer's recommendations.
(2) Charger test[d]	X	Annually	With the batteries fully charged and connected to the charger, place an ampere meter in series with the battery under charge. Verify the charging current is in accordance with the manufacturer's recommendations for the type of battery used. In the absence of specific information, use 1/30 to 1/25 of the battery rating.
(3) Discharge test	X	Annually	With the battery charger disconnected, load test the batteries following the manufacturer's recommendations. Verify the voltage level does not fall below the levels specified. Load testing can be by means of an artificial load equal to the full fire alarm load connected to the battery.
(4) Load voltage test	X	Semiannually	With the battery charger disconnected, load test the batteries following the manufacturer's recommendations. Verify the voltage level does not fall below the levels specified. Load testing can be by means of an artificial load equal to the full fire alarm load connected to the battery. Verify the float voltage for the entire battery is 1.42 volts per cell, nominal, under load. If possible, measure cells individually.

(continues)

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
9. Battery tests *(continued)*			
(c) Sealed lead-acid type			
(1) Battery replacement	X	Annually	Replace batteries in accordance with the recommendations of the alarm equipment manufacturer or when the recharged battery voltage or current falls below the manufacturer's recommendations.
(2) Charger test	X	Annually	With the batteries fully charged and connected to the charger, measure the voltage across the batteries with a voltmeter. Verify the voltage is 2.30 volts per cell ±0.02 volts at 77°F (25°C) or as specified by the equipment manufacturer.
(3) Discharge test	X	Annually	With the battery charger disconnected, load test the batteries following the manufacturer's recommendations. Verify the voltage level does not fall below the levels specified. Load testing can be by means of an artificial load equal to the full fire alarm load connected to the battery.
(4) Load voltage test	X	Semiannually	Verify the battery performs under load, in accordance with the battery manufacturer's specifications.
10. Public emergency alarm reporting system — wired system	X	Daily	Manual tests of the power supply for public reporting circuits shall be made and recorded at least once during each 24-hour period. Such tests shall include the following: (1) Current strength of each circuit. Changes in current of any circuit exceeding 10 percent shall be investigated immediately. (2) Voltage across terminals of each circuit inside of terminals of protective devices. Changes in voltage of any circuit exceeding 10 percent shall be investigated immediately. (3)[c] Voltage between ground and circuits. If this test shows a reading in excess of 50 percent of that shown in the test specified in (2), the trouble shall be immediately located and cleared. Readings in excess of 25 percent shall be given early attention. These readings shall be taken with a calibrated voltmeter of not more than 100 ohms resistance per volt. Systems in which each circuit is supplied by an independent current source (Forms 3 and 4) require tests between ground and each side of each circuit. Common current source systems (Form 2) require voltage tests between ground and each terminal of each battery and other current source. (4) Ground current reading shall be permitted in lieu of (3). If this method of testing is used, all grounds showing a current reading in excess of 5 percent of the supplied line current shall be given immediate attention. (5) Voltage across terminals of common battery on switchboard side of fuses. (6) Voltage between common battery terminals and ground. Abnormal ground readings shall be investigated immediately. Tests specified in (5) and (6) shall apply only to those systems using a common battery. If more than one common battery is used, each common battery shall be tested.
11. Remote annunciators	X	Annually	Verify the correct operation and identification of annunciators. If provided, verify the correct operation of annunciator under a fault condition.
12. Reserved			
13. Reserved			
14. Reserved			
15. Conductors — metallic			
(a) Stray voltage	X	N/A	Test all installation conductors with a volt/ohmmeter to verify that there are no stray (unwanted) voltages between installation conductors or between installation conductors and ground. Verify the maximum allowable stray voltage does not exceed 1 volt ac/dc, unless a different threshold is specified in the published manufacturer's instructions for the installed equipment.
(b) Ground faults	X	N/A	Test all installation conductors, other than those intentionally and permanently grounded, for isolation from ground per the installed equipment manufacturer's published instructions.
(c) Short-circuit faults	X	N/A	Test all installation conductors, other than those intentionally connected together, for conductor-to-conductor isolation per the published manufacturer's instructions for the installed equipment. Also test these same circuits conductor-to-ground.

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
(d) Loop resistance	X	N/A	With each initiating and indicating circuit installation conductor pair short-circuited at the far end, measure and record the resistance of each circuit. Verify that the loop resistance does not exceed the limits specified in the published manufacturer's instructions for the installed equipment.
(e) Circuit integrity	X	N/A	For initial and reacceptance testing, confirm the introduction of a fault in any circuit monitored for integrity results in a trouble indication at the fire alarm control unit. Open one connection at not less than 10 percent of the initiating devices, notification appliances and controlled devices on every initiating device circuit, notification appliance circuit, and signaling line circuit. Confirm all circuits perform as indicated in Sections 23.5, 23.6, and 23.7.
	N/A	Annually	For periodic testing, test each initiating device circuit, notification appliance circuit, and signaling line circuit for correct indication at the control unit. Confirm all circuits perform as indicated in Sections 23.5, 23.6, and 23.7.
16. Conductors — nonmetallic			
(a) Fiber optics	X	N/A	Test the fiber-optic transmission line by the use of an optical power meter or by an optical time domain reflectometer used to measure the relative power loss of the line. Test result data must meet or exceed ANSI/TIA 568-C.3, *Optical Fiber Cabling Components Standard*, related to fiber-optic lines and connection/splice losses and the control unit manufacturer's published specifications.
(b) Circuit integrity	X	N/A	For initial and reacceptance testing, confirm the introduction of a fault in any circuit monitored for integrity results in a trouble indication at the fire alarm control unit. Open one connection at not less than 10 percent of the initiating devices, notification appliances, and controlled devices on every initiating device circuit, notification appliance circuit, and signaling line circuit. Confirm all circuits perform as indicated in Sections 23.5, 23.6, and 23.7.
	N/A	Annually	For periodic testing, test each initiating device circuit, notification appliance circuit, and signaling line circuit for correct indication at the control unit. Confirm all circuits perform as indicated in Sections 23.5, 23.6, and 23.7.
17. Initiating devices[f]			
(a) Electromechanical releasing device			
(1) Nonrestorable-type link	X	Annually	Verify correct operation by removal of the fusible link and operation of the associated device. Lubricate any moving parts as necessary.
(2) Restorable-type link[g]	X	Annually	Verify correct operation by removal of the fusible link and operation of the associated device. Lubricate any moving parts as necessary.
(b) Fire extinguishing system(s) or suppression system(s) alarm switch	X	Annually	Operate the switch mechanically or electrically and verify receipt of signal by the fire alarm control unit.
(c) Fire–gas and other detectors	X	Annually	Test fire–gas detectors and other fire detectors as prescribed by the manufacturer and as necessary for the application.
(d) Heat detectors			
(1) Fixed-temperature, rate-of-rise, rate of compensation, restorable line, spot type (excluding pneumatic tube type)	X	Annually (see 14.4.4.5)	Perform heat test with a listed and labeled heat source or in accordance with the manufacturer's published instructions. Assure that the test method for the installed equipment does not damage the nonrestorable fixed-temperature element of a combination rate-of-rise/fixed-temperature element detector.
(2) Fixed-temperature, nonrestorable line type	X	Annually	Do not perform heat test. Test functionality mechanically and electrically. Measure and record loop resistance. Investigate changes from acceptance test.
(3) Fixed-temperature, nonrestorable spot type	X	See Method	After 15 years from initial installation, replace all devices or have 2 detectors per 100 laboratory tested. Replace the 2 detectors with new devices. If a failure occurs on any of the detectors removed, remove and test additional detectors to determine either a general problem involving faulty detectors or a localized problem involving 1 or 2 defective detectors. If detectors are tested instead of replaced, repeat tests at intervals of 5 years.
(4) Nonrestorable (general)	X	Annually	Do not perform heat tests. Test functionality mechanically and electrically.
(5) Restorable line type, pneumatic tube only	X	Annually	Perform heat tests (where test chambers are in circuit), with a listed and labeled heat source or in accordance with the manufacturer's published instructions of the detector or conduct a test with pressure pump.

(continues)

Table 14.4.3.2 ***Continued***

Component	Initial Acceptance	Periodic Frequency	Method
17. Initiating devices[f]			
(d) Heat detectors *(continued)*			
(6) Single- and multiple-station heat alarms	X	Annually	Conduct functional tests according to manufacturer's published instructions. Do not test nonrestorable heat detectors with heat.
(e) Manual fire alarm boxes	X	Annually	Operate manual fire alarm boxes per the manufacturer's published instructions. Test both key-operated presignal and general alarm manual fire alarm boxes.
(f) Radiant energy fire detectors	X	Semiannually	Test flame detectors and spark/ember detectors in accordance with the manufacturer's published instructions to determine that each detector is operative. Determine flame detector and spark/ember detector sensitivity using any of the following: (1) Calibrated test method (2) Manufacturer's calibrated sensitivity test instrument (3) Listed control unit arranged for the purpose (4) Other approved calibrated sensitivity test method that is directly proportional to the input signal from a fire, consistent with the detector listing or approval If designed to be field adjustable, replace detectors found to be outside of the approved range of sensitivity or adjust to bring them into the approved range. Do not determine flame detector and spark/ember detector sensitivity using a light source that administers an unmeasured quantity of radiation at an undefined distance from the detector.
(g) Smoke detectors — functional test			
(1) In other than one- and two-family dwellings, system detectors	X	Annually	[h]Test smoke detectors in place to ensure smoke entry into the sensing chamber and an alarm response. Use smoke or a listed and labeled product acceptable to the manufacturer or in accordance with their published instructions. Other methods listed in the manufacturer's published instructions that ensure smoke entry from the protected area, through the vents, into the sensing chamber can be used.
(2) Single- and multiple-station smoke alarms connected to protected premises systems	X	Annually	Perform a functional test on all single- and multiple-station smoke alarms connected to a protected premises fire alarm system by putting the smoke alarm into an alarm condition and verifying that the protected premises system receives a supervisory signal and does not cause a fire alarm signal.
(3) System smoke detectors used in one- and two-family dwellings	X	Annually	Conduct functional tests according to manufacturer's published instructions.
(4) Air sampling	X	Annually	Test with smoke or a listed and labeled product acceptable to the manufacturer or in accordance with their published instructions. Test from the end sampling port or point on each pipe run. Verify airflow through all other ports or points.
(5) Duct type	X	Annually	In addition to the testing required in Table 14.4.3.2(g)(1) and Table 14.4.3.2(h), test duct smoke detectors that use sampling tubes to ensure that they will properly sample the airstream in the duct using a method acceptable to the manufacturer or in accordance with their published instructions.
(6) Projected beam type	X	Annually	Test the detector by introducing smoke, other aerosol, or an optical filter into the beam path.
(7) Smoke detector with built-in thermal element	X	Annually	Operate both portions of the detector independently as described for the respective devices.
(8) Smoke detectors with control output functions	X	Annually	Verify that the control capability remains operable even if all of the initiating devices connected to the same initiating device circuit or signaling line circuit are in an alarm state.
(h) Smoke detectors — sensitivity testing			
In other than one- and two-family dwellings, system detectors	N/A	See 14.4.4.3	[i]Perform any of the following tests to ensure that each smoke detector is within its listed and marked sensitivity range: (1) Calibrated test method (2) Manufacturer's calibrated sensitivity test instrument (3) Listed control equipment arranged for the purpose

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
			(4) Smoke detector/control unit arrangement whereby the detector causes a signal at the control unit when its sensitivity is outside its listed sensitivity range (5) Other calibrated sensitivity test method approved by the authority having jurisdiction
(i) Carbon monoxide detectors/carbon monoxide alarms for the purposes of fire detection	X	Annually	Test the devices in place to ensure CO entry to the sensing chamber by introduction through the vents, to the sensing chamber of listed and labeled product acceptable to the manufacturer or in accordance with their published instructions.
(j) Initiating devices, supervisory			
(1) Control valve switch	X	Annually	Operate valve and verify signal receipt to be within the first two revolutions of the handwheel or within one-fifth of the travel distance, or per the manufacturer's published instructions.
(2) High- or low-air pressure switch	X	Annually	Operate switch and verify receipt of signal is obtained where the required pressure is increased or decreased a maximum 10 psi (70 kPa) from the required pressure level.
(3) Room temperature switch	X	Annually	Operate switch and verify receipt of signal to indicate the decrease in room temperature to 40°F (4.4°C) and its restoration to above 40°F (4.4°C).
(4) Water level switch	X	Annually	Operate switch and verify receipt of signal indicating the water level raised or lowered a maximum 3 in. (70 mm) from the required level within a pressure tank, or a maximum 12 in. (300 mm) from the required level of a nonpressure tank. Also verify its restoral to required level.
(5) Water temperature switch	X	Annually	Operate switch and verify receipt of signal to indicate the decrease in water temperature to 40°F (4.4°C) and its restoration to above 40°F (4.4°C).
(k) Mechanical, electrosonic, or pressure-type waterflow device	X	Semiannually	Water shall be flowed through an inspector's test connection indicating the flow of water equal to that from a single sprinkler of the smallest orifice size installed in the system for wet-pipe systems, or an alarm test bypass connection for dry-pipe, pre-action, or deluge systems in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.*
(l) Multi-sensor fire detector or multi-criteria fire detector or combination fire detector	X	Annually	Test each of the detection principles present within the detector (e.g., smoke/heat/CO, etc.) independently for the specific detection principle, regardless of the configuration status at the time of testing. Also test each detector in accordance with the published manufacturer's instructions. Test individual sensors together if the technology allows individual sensor responses to be verified. Perform tests as described for the respective devices by introduction of the physical phenomena to the sensing chamber of element, and an electronic check (magnets, analogue values, etc.) is not sufficient to comply with this requirement. Confirm the result of each sensor test through indication at the detector or control unit. Where individual sensors cannot be tested individually, test the primary sensor.[j] Record all tests and results.
18. Special hazard equipment			
(a) Abort switch (dead-man type)	X	Annually	Operate abort switch and verify correct sequence and operation.
(b) Abort switch (recycle type)	X	Annually	Operate abort switch and verify development of correct matrix with each sensor operated.
(c) Abort switch (special type)	X	Annually	Operate abort switch and verify correct sequence and operation in accordance with authority having jurisdiction. Observe sequencing as specified on as-built drawings or in system owner's manual.
(d) Cross-zone detection circuit	X	Annually	Operate one sensor or detector on each zone. Verify occurrence of correct sequence with operation of first zone and then with operation of second zone.
(e) Matrix-type circuit	X	Annually	Operate all sensors in system. Verify development of correct matrix with each sensor operated.
(f) Release solenoid circuit[k]	X	Annually	Verify operation of solenoid.
(g) Squibb release circuit	X	Annually	Use AGI flashbulb or other test light approved by the manufacturer. Verify operation of flashbulb or light.
(h) Verified, sequential, or counting zone circuit	X	Annually	Operate required sensors at a minimum of four locations in circuit. Verify correct sequence with both the first and second detector in alarm.
(i) All above devices or circuits or combinations thereof	X	Annually	Verify supervision of circuits by creating an open circuit.

(continues)

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
19. Combination systems			
(a) Fire extinguisher electronic monitoring device/system	X	Annually	Test communication between the device connecting the fire extinguisher electronic monitoring device/system and the fire alarm control unit to ensure proper signals are received at the fire alarm control unit and remote annunciator(s) if applicable.
(b) Carbon monoxide[l] device/system	X	Annually	Test communication between the device connecting the carbon monoxide device/system and the fire alarm control unit to ensure proper signals are received at the fire alarm control unit and remote annunciator(s) if applicable.
20. Interface equipment[m]	X	See 14.4.4.4	Test interface equipment connections by operating or simulating the equipment being supervised. Verify signals required to be transmitted are received at the control unit. Test frequency for interface equipment is the same as the frequency required by the applicable NFPA standard(s) for the equipment being supervised.
21. Guard's tour equipment	X	Annually	Test the device in accordance with the manufacturer's published instructions.
22. Alarm notification appliances			
(a) Audible[n]	X	N/A	For initial and reacceptance testing, measure sound pressure levels for signals with a sound level meter meeting ANSI S1.4a, *Specifications for Sound Level Meters,* Type 2 requirements. Measure sound pressure levels throughout the protected area to confirm that they are in compliance with Chapter 18. Set the sound level meter in accordance with ANSI S3.41, *American National Standard Audible Evacuation Signal,* using the time-weighted characteristic F (FAST).
	N/A	Annually	[o]For periodic testing, verify the operation of the notification appliances.
(b) Audible textual notification appliances (speakers and other appliances to convey voice messages)	X	N/A	For initial and reacceptance testing, measure sound pressure levels for signals with a sound level meter meeting ANSI S1.4a, *Specifications for Sound Level Meters,* Type 2 requirements. Measure sound pressure levels throughout the protected area to confirm that they are in compliance with Chapter 18. Set the sound level meter in accordance with ANSI S3.41, *American National Standard Audible Evacuation Signal,* using the time-weighted characteristic F (FAST). Verify audible information to be distinguishable and understandable and in compliance with 14.4.11.
	N/A	Annually	[o]For periodic testing, verify the operation of the notification appliances.
(c) Visible	X	N/A	Perform initial and reacceptance testing in accordance with the manufacturer's published instructions. Verify appliance locations to be per approved layout and confirm that no floor plan changes affect the approved layout. Verify that the candela rating marking agrees with the approved drawing. Confirm that each appliance flashes.
	N/A	Annually	For periodic testing, verify that each appliance flashes.
23. Exit marking audible notification appliance	X	Annually	Perform tests in accordance with manufacturer's published instructions.
24. Emergency control functions[p]	X	Annually	For initial, reacceptance, and periodic testing, verify emergency control function interface device activation. Where an emergency control function interface device is disabled or disconnected during initiating device testing, verify that the disabled or disconnected emergency control function interface device has been properly restored. [
25. Area of refuge two-way communication system	X	Annually	At a minimum, test the two-way communication system to verify operation and receipt of visual and audible signals at the transmitting and receiving unit respectively. Operate systems with more than five stations with a minimum of five stations operating simultaneously. Verify voice quality and clarity.
26. Special procedures			
(a) Alarm verification	X	Annually	Verify time delay and alarm response for smoke detector circuits identified as having alarm verification.
(b) Multiplex systems	X	Annually	Verify communications between sending and receiving units under both primary and secondary power. Verify communications between sending and receiving units under open-circuit and short-circuit trouble conditions.

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
			Verify communications between sending and receiving units in all directions where multiple communications pathways are provided. If redundant central control equipment is provided, verify switchover and all required functions and operations of secondary control equipment. Verify all system functions and features in accordance with manufacturer's published instructions.
27. Supervising station alarm systems — receiving equipment			
(a) All equipment	X	Monthly	Perform tests on all system functions and features in accordance with the equipment manufacturer's published instructions for correct operation in conformance with the applicable sections of Chapter 26. Actuate initiating device and verify receipt of the correct initiating device signal at the supervising station within 90 seconds. Upon completion of the test, restore the system to its functional operating condition. If test jacks are used, perform the first and last tests without the use of the test jack.
(b) Digital alarm communicator receiver (DACR)	X	Monthly	Disconnect each transmission means in turn from the DACR, and verify audible and visual annunciation of a trouble signal in the supervising station. Cause a signal to be transmitted on each individual incoming DACR line (path) at least once every 6 hours (24 hours for DACTs installed prior to adoption of the 2013 edition of *NFPA 72*). Verify receipt of these signals.
(c) Digital alarm radio receiver (DARR)	X	Monthly	Cause the following conditions of all DARRs on all subsidiary and repeater station receiving equipment. Verify receipt at the supervising station of correct signals for each of the following conditions: (1) AC power failure of the radio equipment (2) Receiver malfunction (3) Antenna and interconnecting cable failure (4) Indication of automatic switchover of the DARR (5) Data transmission line failure between the DARR and the supervising or subsidiary station
(d) McCulloh systems	X	Monthly	Test and record the current on each circuit at each supervising and subsidiary station under the following conditions: (1) During functional operation (2) On each side of the circuit with the receiving equipment conditioned for an open circuit Cause a single break or ground condition on each transmission channel. If such a fault prevents the functioning of the circuit, verify receipt of a trouble signal. Cause each of the following conditions at each of the supervising or subsidiary stations and all repeater station radio transmitting and receiving equipment; verify receipt of correct signals at the supervising station: (1) RF transmitter in use (radiating) (2) AC power failure supplying the radio equipment (3) RF receiver malfunction (4) Indication of automatic switchover
(e) Radio alarm supervising station receiver (RASSR) and radio alarm repeater station receiver (RARSR)	X	Monthly	Cause each of the following conditions at each of the supervising or subsidiary stations and all repeater station radio transmitting and receiving equipment; verify receipt of correct signals at the supervising station: (1) AC power failure supplying the radio equipment (2) RF receiver malfunction (3) Indication of automatic switchover, if applicable
(f) Private microwave radio systems	X	Monthly	Cause each of the following conditions at each of the supervising or subsidiary stations and all repeater station radio transmitting and receiving equipment; verify receipt of correct signals at the supervising station: (1) RF transmitter in use (radiating) (2) AC power failure supplying the radio equipment (3) RF receiver malfunction (4) Indication of automatic switchover

(continues)

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
27. Supervising station alarm systems — receiving equipment *(continued)*			
(g) Performance-based technologies	X	Monthly	Perform tests to ensure the monitoring of integrity of the transmission technology and technology path. Where a single communications path is used, disconnect the communication path. Verify that failure of the path is annunciated at the supervising station within 60 minutes of the failure (within 5 minutes for communication equipment installed prior to adoption of the 2013 edition of *NFPA 72*). Restore the communication path. Where multiple communication paths are used, disconnect both communication paths and confirm that failure of the path is annunciated at the supervising station within not more than 6 hours of the failure (within 24 hours for communication equipment installed prior to adoption of the 2013 edition of *NFPA 72*). Restore both communication paths.
28. Public emergency alarm reporting system transmission equipment			
(a) Publicly accessible alarm box	X	Semiannually	Actuate publicly accessible initiating device(s) and verify receipt of not less than three complete rounds of signal impulses. Perform this test under normal circuit conditions. If the device is equipped for open circuit operation (ground return), test it in this condition as one of the semiannual tests.
(b) Auxiliary box	X	Annually	Test each initiating circuit of the auxiliary box by actuation of a protected premises initiating device connected to that circuit. Verify receipt of not less than three complete rounds of signal impulses.
(c) Master box			
(1) Manual operation	X	Semiannually	Perform the tests prescribed for 28(a).
(2) Auxiliary operation	X	Annually	Perform the tests prescribed for 28(b).
29. Low-power radio (wireless systems)	X	N/A	The following procedures describe additional acceptance and reacceptance test methods to verify wireless protection system operation: (1) Use the manufacturer's published instructions and the as-built drawings provided by the system supplier to verify correct operation after the initial testing phase has been performed by the supplier or by the supplier's designated representative. (2) Starting from the functional operating condition, initialize the system in accordance with the manufacturer's published instructions. Confirm the alternative communications path exists between the wireless control unit and peripheral devices used to establish initiation, indication, control, and annunciation. Test the system for both alarm and trouble conditions. (3) Check batteries for all components in the system monthly unless the control unit checks all batteries and all components daily.
30. Mass notification systems			
(a) Functions	X	Annually	At a minimum, test control equipment to verify correct receipt of alarm, supervisory, and trouble signals (inputs); operation of evacuation signals and auxiliary functions (outputs); circuit supervision, including detection of open circuits and ground faults; and power supply supervision for detection of loss of ac power and disconnection of secondary batteries.
(b) Fuses	X	Annually	Verify the rating and supervision.
(c) Interfaced equipment	X	Annually	Verify integrity of single or multiple circuits providing interface between two or more control units. Test interfaced equipment connections by operating or simulating operation of the equipment being supervised. Verify signals required to be transmitted at the control unit.
(d) Lamps and LEDs	X	Annually	Illuminate lamps and LEDs.
(e) Primary (main) power supply	X	Annually	Disconnect all secondary (standby) power and test under maximum load, including all alarm appliances requiring simultaneous operation. Reconnect all secondary (standby) power at end of test. For redundant power supplies, test each separately.
(f) Audible textual notification appliances (speakers and other appliances to convey voice messages)	X	Annually	Measure sound pressure level with a sound level meter meeting ANSI S1.4a, *Specifications for Sound Level Meters,* Type 2 requirements. Measure and record levels throughout protected area. Set the sound level meter in accordance with ANSI S3.41, *American National Standard Audible Evacuation Signal,* using the time-weighted characteristic F (FAST). Record the maximum output when the audible emergency evacuation signal is on. Verify audible information to be distinguishable and understandable.

Table 14.4.3.2 *Continued*

Component	Initial Acceptance	Periodic Frequency	Method
(g) Visible	X	Annually	Perform test in accordance with manufacturer's published instructions. Verify appliance locations to be per approved layout and confirm that no floor plan changes affect the approved layout. Verify that the candela rating marking agrees with the approved drawing. Confirm that each appliance flashes.
(h) Control unit functions and no diagnostic failures are indicated	X	Annually	Review event log file and verify that the correct events were logged. Review system diagnostic log file; correct deficiencies noted in file. Delete unneeded log files. Delete unneeded error files. Verify that sufficient free disk space is available. Verify unobstructed flow of cooling air is available. Change/clean filters, cooling fans, and intake vents.
(i) Control unit reset	X	Annually	Power down the central control unit computer and restart it.
(j) Control unit security	X	Annually	If remote control software is loaded onto the system, verify that it is disabled to prevent unauthorized system access.
(k) Audible/visible functional test	X	Annually	Send out an alert to a diverse set of predesignated receiving devices and confirm receipt. Include at least one of each type of receiving device.
(l) Software backup	X	Annually	Make full system software backup. Rotate backups based on accepted practice at site.
(m) Secondary power test	X	Annually	Disconnect ac power. Verify the ac power failure alarm status on central control equipment. With ac power disconnected, verify battery voltage under load.
(n) Wireless signals	X	Annually	Check forward/reflected radio power is within specifications.
(o) Antenna	X	Annually	Check forward/reflected radio power is within specifications. Verify solid electrical connections with no observable corrosion.
(p) Transceivers	X	Annually	Verify proper operation and mounting is not compromised.

[a]Some transmission equipment (such as but not limited to cable modems, fiber-optic interface nodes, and VoIP interfaces) are typically powered by the building's electrical system using a standby power supply that does not meet the requirements of this Code. This is intended to ensure that the testing authority verifies full standby power as required by Chapter 10. Additionally, refer to Table 14.4.3.2, Items 7 through 9 for secondary power supply testing.

[b]The automatic transmission of the check-in (handshake) signal can take up to 60 minutes to occur.

[c]See Table 14.4.3.2, Item 4(a) for the testing of transmission equipment.

[d]Example: 4000 mAh × 1/25 = 160 mA charging current at 77°F (25°C).

[e]The voltmeter sensitivity has been changed from 1000 ohms per volt to 100 ohms per volt so that the false ground readings (caused by induced voltages) are minimized.

[f]Initiating devices such as smoke detectors used for elevator recall, closing dampers, or releasing doors held in the open position that are permitted by the Code *(see* NFPA *101, Life Safety Code, 9.6.3)* to initiate supervisory signals at the fire alarm control unit (FACU) should be tested at the same frequency (annual) as those devices when they are generating an alarm signal. They are not supervisory devices, but they initiate a supervisory signal at the FACU.

[g]Fusible thermal link detectors are commonly used to close fire doors and fire dampers. They are actuated by the presence of external heat, which causes a solder element in the link to fuse, or by an electric thermal device, which, when energized, generates heat within the body of the link, causing the link to fuse and separate.

[h]Note, it is customary for the manufacturer of the smoke detector to test a particular product from an aerosol provider to determine acceptability for use in smoke entry testing of their smoke detector/ smoke alarm. Magnets are not acceptable for smoke entry tests.

[i] There are some detectors that use magnets as a manufacturer's calibrated sensitivity test instrument.

[j]For example, it might not be possible to individually test the heat sensor in a thermally enhanced smoke detector.

[k]Manufacturer's instructions should be consulted to ensure a proper operational test. No suppression gas or agent is expected to be discharged during the test of the solenoid. See Test Plan of 14.2.10.

[l]Testing of CO device should be done to the requirements of NFPA 720, *Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment.*

[m]A monitor module installed on an interface device is not considered a supervisory device and therefore not subject to the quarterly testing frequency requirement. Test frequencies for interface devices should be in accordance with the applicable standard. For example, fire pump controller alarms such as phase reversal are required to be tested annually. If a monitor module is installed to identify phase reversal on the fire alarm control panel, it is not necessary to test for phase reversal four times a year.

[n]Chapter 18 would require 15 dB over average ambient sound for public mode spaces. Sometimes the ambient sound levels are different from what the design was based upon. Private operating mode would require 10 dB over average ambient at the location of the device.

[o]Where building, system, or occupancy changes have been observed, the owner should be notified of the changes. New devices might need to be installed and tested per the initial acceptance testing criteria.

[p]See A.14.4.3.2, and Table 14.4.3.2, Item 24.

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6.4.8.3 Failure to receive positive confirmation after activation or cessation of such positive confirmation while the system or subsystem remains activated shall result in an off-normal indication at the smoke control system within 200 seconds.

6.4.8.4 Fire alarm signaling paths to the smoke control system shall be monitored for integrity in accordance with 10.17.1 of *NFPA 72, National Fire Alarm and Signaling Code*, with trouble annunciation provided at the FSCS, unless both of the following conditions are met:

(1) The interconnecting wiring between the fire alarm system and the smoke control system is located within 20 ft (6.1 m) of each other.
(2) The conductors are installed in conduit or equivalently protected against mechanical injury.

6.4.8.5 Ground-fault annunciation shall not be required where receipt of the activation signal by the smoke control system is not affected by a single ground fault.

6.4.8.6 Operational capability of dedicated smoke control equipment shall be verified using the weekly self-test function provided by the UUKL-listed smoke control panel mandated by 6.4.1.

6.5 Energy Management. Energy management systems, particularly those that cycle supply, return, and exhaust fans for energy conservation, shall be overridden when their control or operation is in conflict with a smoke control mode.

6.6 Materials.

6.6.1 Materials used for systems providing smoke control shall conform to NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and other applicable NFPA documents.

6.6.2 Duct materials shall be selected and ducts shall be designed to convey smoke, to withstand additional pressure (both positive and negative) by the supply and exhaust fans when operating in a smoke control mode, and to maintain their structural integrity during the period for which the system is designed to operate.

6.6.3* Equipment, including but not limited to fans, ducts, and balance dampers, shall be suitable for its intended use and the probable temperatures to which it is likely to be exposed.

6.7 Electric Services Installation.

6.7.1 All electrical installations shall meet the requirements of *NFPA 70, National Electrical Code.*

6.7.2 The smoke control system shall be designed so that loss of normal power for a period of up to 15 minutes will result in the components automatically performing their function upon restoration of power.

6.7.3 Where standby power is provided in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*, the standby power source and related transfer switches shall be separated from transformers and switch gear for the primary power supply and enclosed in a room with a 1-hour fire resistance–rated fire barrier wall installed in accordance with NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls.*

Chapter 7 Smoke Control System Documentation

7.1 Documentation Required. The following documents shall be generated by the designer during the design process:

(1) Detailed design report
(2) Operations and maintenance manual

7.2 Detailed Design Report.

7.2.1 The detailed design report shall provide documentation of the smoke control system as it is designed and intended to be installed.

7.2.2 The design report shall include the following elements, if applicable:

(1) System purpose
(2) System design objectives
(3) Design approach
(4) Design assumptions (building height, ambient conditions, reliance on other fire protection systems, leakage, etc.)
(5) Location of smoke zone(s)
(6) Design pressure differences
(7) Building use limitations that arise out of the system design
(8) Design calculations
(9) Fan and duct specifications
(10) Damper specifications
(11) Detailed inlet or exhaust inlets site information
(12) Detailed method of activation
(13) Smoke control system operation logic
(14) System commissioning procedures

7.3* Operations and Maintenance Manual. The operations and maintenance manual shall provide the requirements to ensure the proper operation of the system over the life of the building.

7.3.1 The operations and maintenance manual shall include the following:

(1) The procedures used in the initial commissioning of the system as well as the measured performance of the system at the time of commissioning
(2) The testing and inspection requirements for the system and system components and the required frequency of testing *(see Chapter 8)*
(3) The critical design assumptions used in the design and limitations on the building and its use that arise out of the design assumptions and limitations
(4) The purpose of the smoke control system

7.3.2 Copies of the operations and maintenance manual shall be provided to the owner and the authorities having jurisdiction.

7.3.3 The building owner shall be responsible for all system testing and shall maintain records of all periodic testing and maintenance in accordance with the operations and maintenance manual.

7.3.4 The building owner shall be responsible for limiting the use of the space in a manner consistent with the limitations provided in the operations and maintenance manual.

Chapter 8 Testing

8.1* General.

8.1.1 Each smoke control system shall be tested against its specific design criteria.

8.1.2 Testing shall confirm that the design objectives described in Section 4.1 are achieved.

8.1.3 Design documents shall include all acceptance testing procedures and pass/fail criteria.

8.1.4* Responsibility for each phase of the testing shall be defined clearly prior to commencing inspection and testing.

8.2 Preliminary Building Inspections.

8.2.1 Prior to testing, the party responsible for testing shall verify completeness of building construction.

8.2.2 The following architectural features, where applicable, shall be inspected:

(1) Smoke barriers, including joints therein
(2) Shaft integrity
(3) Firestopping
(4) Doors/closers
(5) Glazing, including that enclosing a large-volume space
(6) Partitions and ceilings

8.3* Component System Testing.

8.3.1 An operational test of each smoke control system component and subsystem shall be performed prior to the acceptance test.

8.3.2 Operational tests shall be performed prior to interconnection of individual components and subsystems to the smoke control system.

8.3.3* Smoke control system operational testing shall include all subsystems to the extent that they affect the operation of the smoke control system.

8.3.4 Requirements and responsibilities for each component test shall be identified in the design documentation.

8.3.5 All documentation from component system testing relative to the smoke control system shall be included in the final testing documentation.

8.4 Acceptance Testing.

8.4.1* General. Acceptance testing shall demonstrate that the final integrated system installation complies with the specific design and is functioning properly.

8.4.2* Test Parameters. Where appropriate to the design, all parameters shall be measured during acceptance testing.

8.4.3* Measurement Locations. The locations for measurement of the parameters identified in 8.4.2 shall be in accordance with nationally recognized methods.

8.4.4 Testing Procedures. The acceptance testing shall include the procedures described in 8.4.4.1 through 8.4.4.4.

8.4.4.1* Prior to beginning acceptance testing, all building equipment shall be placed in the normal operating mode, including equipment that is not used to implement smoke control.

8.4.4.2* If standby power has been provided for the operation of the smoke control system, the acceptance testing shall be conducted while on both normal and standby power.

8.4.4.3 The acceptance testing shall include demonstrating that the correct outputs are produced for a given input for each control sequence specified.

8.4.4.4 The complete smoke control sequence shall be demonstrated for the following:

(1) Normal mode
(2)*Automatic smoke control mode for first alarm
(3) Transfer to standby power if provided.
(4) Return to normal

8.4.4.5 The force necessary to open each egress door shall be measured using a spring-type scale and recorded.

8.4.4.6 Door-opening forces shall not exceed those allowed by the building code.

8.4.4.7 Activation of each smoke control system response to all means of activation, both automatic and manual, as specified in the design report and operations and maintenance manual in Chapter 7, shall be verified and recorded.

8.4.4.8 The proper operation of all fans, dampers, and related equipment, as outlined by the project documents referenced in 6.4.4.1.4, shall be verified and recorded.

8.4.5* Testing of Smoke Management Systems in Large-Volume Spaces. Acceptance testing to verify systems performance shall include the following:

(1) Prior to performance testing:
   (a) Verify the exact location of the perimeter of each large-volume space smoke management system, identify any door openings into that space, and identify all adjacent areas that are to remain open and that are to be protected by airflow alone.
   (b) For larger openings, measure the velocity by making appropriate traverses of the opening.
(2) Activate the smoke management system, then do the following:
   (a) Verify and record the operation of all fans, dampers, doors, and related equipment.
   (b) Measure fan exhaust capacities and air velocities through inlet doors and grilles or at supply grilles if there is a mechanical makeup air system.
   (c) Measure the force to open exit doors.
(3) Where appropriate to the design, measure and record the pressure difference across all doors that separate the smoke management system area from adjacent spaces and the velocities at interfaces with open areas.

8.4.6 Testing of Smoke Containment Systems.

8.4.6.1 Pressure Testing.

8.4.6.1.1 With the containment system activated, the pressure difference across each smoke barrier shall be measured and recorded with all interior doors closed.

8.4.6.1.2 If an exterior door would normally be open during evacuation, it shall be open during testing.

8.4.6.1.3 The HVAC system shall be off unless the normal mode is to leave the HVAC system on during smoke control operations.

8.4.6.1.4* With the containment system activated and the number of egress doors used in the system design open, the pressure difference across the barrier shall be measured and recorded.

8.4.6.1.5 No pressure difference shall be less than the minimum design pressure differences in Table 4.4.2.1.1 or the pressures specified in the design documents.

8.4.6.2* Force Testing.

8.4.6.2.1 With the containment system activated and the number of doors used in the system design open, the force necessary to open each egress door shall be measured and recorded.

8.4.6.2.2 All other doors shall be closed when the measurements specified in 8.4.6.2.1 are made.

8.4.6.3 Stairwell Pressurization Systems.

8.4.6.3.1 The requirements in 8.4.6.3 shall apply where stairwell pressurization is the only smoke control system in the building.

8.4.6.3.2 Where stairwell pressurization is used in combination with zoned smoke control, the requirements of 8.4.6.7.1 shall apply.

8.4.6.3.3 Pressurized stairwell vestibules shall be treated as a zone in a zoned smoke control system. *(See 8.4.6.4.)*

8.4.6.4* Zoned Smoke Control System.

8.4.6.4.1 The requirements in 8.4.6.4 shall apply where zoned smoke control is the only smoke control system in the building.

8.4.6.4.2 Normal HVAC Mode.

8.4.6.4.2.1 The pressure difference across all smoke control zones that divide a building floor shall be measured and recorded while the HVAC systems serving the floor's smoke zones are operating in their normal (non-smoke control) mode and while all smoke barrier doors that separate the floor zones are closed.

8.4.6.4.3 Smoke Control Mode for Each Smoke Control Zone.

8.4.6.4.3.1 Each separate smoke control zone shall be activated by a simulated fire alarm input.

8.4.6.4.3.2 The pressure difference across all smoke barriers that separate the smoke zone from adjacent zones shall be measured and recorded.

8.4.6.4.3.3 The measurements shall be made while all smoke barrier doors that separate the smoke zone from the other zones are fully closed.

8.4.6.4.3.4 One measurement shall be made across each smoke barrier or set of doors, and the data shall clearly indicate the higher and lower pressure sides of the doors or barriers.

8.4.6.4.3.5 Doors that have a tendency to open slightly due to the pressure difference shall have one pressure measurement made while held closed and another made while not held closed.

8.4.6.4.3.6* Testing, as described in 8.4.6.4.3.1, shall continue until all fire alarm inputs have been activated.

8.4.6.5* Elevator Smoke Control Systems.

8.4.6.5.1 Elevator Hoistway Pressurization Systems.

8.4.6.5.1.1 General.

(A) The requirements in 8.4.6.5.1 shall apply where elevator hoistway pressurization is the only smoke control system in the building.

(B) Where elevator hoistway pressurization is used in combination with zoned smoke control, the requirements of 8.4.6.7.3 shall apply.

8.4.6.5.1.2 Pressure Testing.

(A) With the elevator pressurization system activated, the pressure difference across each elevator door with all elevator doors closed shall be measured and recorded.

(B) If the elevator door on the recall floor would normally be open during system pressurization, it shall be open during testing.

(C) The HVAC system shall be off unless the normal mode is to leave the HVAC system on during smoke control operations.

(D) If the elevator pressurization system has been designed to operate during elevator movement, the tests in 8.4.6.5.1.2(A) through 8.4.6.5.1.2(C) shall be repeated under these conditions.

8.4.6.5.2 Lobby Pressurization Systems.

8.4.6.5.2.1 General.

(A) The requirements in 8.4.6.5.2 shall apply where enclosed elevator lobby pressurization is the only smoke control system in the building.

(B) Where elevator lobby pressurization is used in combination with zoned smoke control, the requirements of 8.4.6.7.3 shall apply.

(C)* Where enclosed elevator lobbies are pressurized by an elevator lobby pressurization system, or where enclosed elevator lobbies receive secondary pressurization from the elevator hoistway, the requirements of 8.4.6.7.3 shall apply.

8.4.6.6 Smoke Refuge Area.

8.4.6.6.1 A smoke refuge area shall be treated as a zone in a zoned smoke control system.

8.4.6.6.2 The tests outlined in 8.4.6.4 shall be conducted.

8.4.6.7 Combination of Smoke Control Systems.

8.4.6.7.1* Stairwell and Zoned Smoke Control System.

8.4.6.7.1.1 The stairwell pressurization system shall be considered as one zone in a zoned smoke control system.

8.4.6.7.1.2 The tests outlined in 8.4.6.1, 8.4.6.2, and 8.4.6.4 shall be conducted.

8.4.6.7.1.3 All tests shall be conducted with both systems operating in response to a simulated fire alarm input.

8.4.6.7.2 Smoke Refuge Area and Zoned Smoke Control System.

8.4.6.7.2.1 A smoke refuge area shall be treated as a separate zone in a zoned smoke control system.

8.4.6.7.2.2 The tests outlined 8.4.6.4 shall be conducted.

8.4.6.7.3 Elevator Pressurization and Zoned Smoke Control System.

8.4.6.7.3.1 The elevator pressurization system shall be considered as one zone in a zoned smoke control system.

8.4.6.7.3.2 Each elevator lobby in an enclosed elevator lobby pressurization system shall be considered as one zone in a zoned smoke control system.

8.4.6.7.3.3 The tests outlined in 8.4.6.4 shall be conducted.

8.4.6.7.3.4 The tests outlined in 8.4.6.5.1 shall be conducted if a hoistway pressurization system is present.

8.4.6.7.3.5 The tests outlined in 8.4.6.5.2 shall be conducted if a lobby pressurization system is present.

8.4.6.7.3.6 The tests outlined in both 8.4.6.5.1 and 8.4.6.5.2 shall be conducted if both systems are present.

8.4.7 Tests of Fire Fighter's Smoke Control Station.

8.4.7.1 All inputs to and outputs from the FSCS shall be tested.

8.4.7.2 Tests shall include manual override of normal and automatic smoke control modes.

8.5 Testing Documentation.

8.5.1* Upon completion of acceptance testing, a copy of all operational testing documentation shall be provided to the owner and to the authority having jurisdiction.

8.5.2 Owner's manuals containing complete data on the smoke control system and instructions for operating and maintaining the system shall be provided to the owner.

8.6 Periodic Testing.

8.6.1* Proper maintenance of the system shall, as a minimum, include the periodic testing of all equipment, such as initiating devices, fans, dampers, controls, doors, and windows.

8.6.2 The equipment shall be maintained in accordance with the manufacturer's recommendations.

8.6.3 The periodic tests shall determine the airflow quantities and the pressure differences at the following locations:

(1) Across smoke barrier openings
(2) At the air makeup supplies
(3) At smoke exhaust equipment

8.6.4 All data points shall coincide with the acceptance test location to facilitate comparison measurements.

8.6.5 The system shall be tested by persons who are thoroughly knowledgeable in the operation, testing, and maintenance of the systems.

8.6.5.1 The results of the tests shall be documented in the operations and maintenance log and made available for inspection.

8.6.5.2 The smoke control system shall be operated for each sequence in the current design criteria.

8.6.5.3 The operation of the correct outputs for each given input shall be observed.

8.6.5.4 Tests shall also be conducted under standby power if applicable.

8.6.6 Special arrangements shall be considered for the introduction of large quantities of outside air into occupied areas or sensitive equipment spaces when outside temperature and humidity conditions are extreme and when such unconditioned air could damage contents.

8.6.7 Dedicated systems shall be tested at least semiannually.

8.6.8 Nondedicated systems shall be tested at least annually.

8.7 Modifications.

8.7.1* All operational and acceptance testing shall be performed on the applicable part of the system whenever the system is changed or modified.

8.7.2 If the smoke control system or the zone boundaries have been modified since the last test, acceptance testing shall be conducted on the portion modified.

8.7.3 Documentation shall be updated to reflect these changes or modifications.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 This standard incorporates methods for applying engineering calculations and reference models to provide a designer with the tools to develop smoke control system designs. The designs are based on select design objectives presented in Section 4.1.

This standard addresses the following topics:

(1) Basic physics of smoke movement in indoor spaces
(2) Methods of smoke control
(3) Supporting data and technology
(4) Building equipment and controls applicable to smoke control systems
(5) Approaches to testing and maintenance methods

This standard does not address the interaction of sprinklers and smoke control systems. The cooling effect of sprinklers can result in some of the smoke losing buoyancy and migrating downward below the design smoke layer interface. This standard also does not provide methodologies to assess the effects of smoke exposure on people, property, or mission continuity.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

A.3.3.2 Ceiling Jet. Normally, the temperature of the ceiling jet is greater than the adjacent smoke layer.

A.3.3.4 Design Pressure Difference. Protected spaces include the nonsmoke zones in a zoned smoke control system, the stairwells in a stairwell pressurization system, a smoke refuge area, and the elevator shaft in an elevator hoistway system.

A.3.3.8 Fire Fighters' Smoke Control Station (FSCS). Other fire fighters' systems (such as voice alarm, public address, fire

APPENDIX K
FIRE ALARM BATTERY CALCS
NORTH AND SOUTH TOWER

AZ AFAA
NAC Voltage Drop Calculator
for Audio / Visual devices

This calculator provided voltage drop calculations in three formats (Point to Point, End of Line, and Load Centering).

Make sure that you know what method is accepted by, and the results do not exceed the limits set by the respective jurisdiction

						Point to Point Method			**End of Line Method**			**Load Centering Method**		
Project Name		FPE 522 Final Exam				**CIRCUIT IS WITHIN LIMITS**			**CIRCUIT IS WITHIN LIMITS**			**CIRCUIT IS WITHIN LIMITS**		
Date		6/5/2014												
Circuit Number		NAC2 - North				Totals		Voltage	Totals		Voltage	Totals		Voltage
Area Covered						Current	Distance	Drop	Current	Distance	Drop	Current	Distance	Drop
Nominal System Voltage			20.4			2.003	550	**2.18**	2.003	550	**4.363**	2.003	550	**2.181**
Minimum Device Voltage			16			End of Line Voltage		**18.22**	End of Line Voltage		**16.04**	End of Line Voltage		**18.22**
Total Circuit Current		2.003		Wire	Ohm's	Percent Drop		10.70%	Percent Drop		21.38%	Percent Drop		10.69%
				Gauge	Per 1000	End of Line and Load Centering Methods use only the wire guage for the first device to source								
Distance from source to 1st device			20	12	1.98	Standard Wire Resistance in Ohms per 1000 feet.								
Wire Gauge for balance of circuit				12	1.98			18=7.77	16=4.89	14=3.07	12=1.98	10=1.24		
Enter current in amps.		Distance					18-14 Awg = Solid Conductors			12-10 Awg = Stranded Conductors				
.150 = 150 ma		from		Voltage		Notes:								
Device	Device	previous	At	Drop from	Percent	Wire resistance is doubled in the calculations for two wires (Positive and Negative)								
Number	Current	device	Device	source	Drop	The voltage calculated to the last device in any method must not be lower then								
Device 1	0.068	20	20.24	0.159	0.78%	the manufactures listed minimum operating voltage (IE: rated operating voltage 20-32 VDC).								
Device 2	0.068	40	19.93	0.465	2.28%									
Device 3	0.161	20	19.79	0.613	3.00%	Device Manufacturer		GE Security			Device Manufacturer		GE Security	
Device 4	0.161	30	19.58	0.816	4.00%				Current					Current
Device 5	0.094	20	19.46	0.938	4.60%	Horn Strobes			@Rated		Strobe Only			@Rated
Device 6	0.094	30	19.29	1.110	5.44%	Model #		Candela	Voltage		Model #		Candela	Voltage
Device 7	0.068	30	19.13	1.272	6.23%	G1-HVDM High dB		15	0.081					
Device 8	0.094	10	19.08	1.323	6.48%	G1-HVDM High dB		30	0.094					
Device 9	0.094	30	18.94	1.465	7.18%	G1-HVDM High dB		75	0.161					
Device 10	0.094	20	18.85	1.552	7.61%	G1-HVDM High dB		110	0.203					
Device 11	0.094	30	18.73	1.671	8.19%	G1-HVDM Low dB		15	0.068					
Device 12	0.161	30	18.62	1.780	8.73%	G1-HVDM Low dB		30	0.088					
Device 13	0.094	30	18.53	1.869	9.16%	G1-HVDM Low dB		75	0.156					
Device 14	0.094	30	18.45	1.947	9.55%	G1-HVDM Low dB		110	0.197					
Device 15	0.094	30	18.39	2.014	9.87%									
Device 16	0.094	30	18.33	2.070	10.15%									
Device 17	0.094	30	18.29	2.115	10.37%									
Device 18	0.094	30	18.25	2.148	10.53%									
Device 19	0.094	30	18.23	2.171	10.64%									
Device 20	0.094	30	18.22	2.182	10.70%									
Totals	2.003	550	End of Line Voltage		**18.22**									

AZ AFAA
NAC Voltage Drop Calculator
for Audio / Visual devices

This calculator provided voltage drop calculations in three formats (Point to Point, End of Line, and Load Centering).

Make sure that you know what method is accepted by, and the results do not exceed the limits set by the respective jurisdiction

						Point to Point Method			**End of Line Method**			**Load Centering Method**		
Project Name		FPE 522 Final Exam				**CIRCUIT IS WITHIN LIMITS**			**CIRCUIT IS WITHIN LIMITS**			**CIRCUIT IS WITHIN LIMITS**		
Date		6/5/2014												
Circuit Number		NAC1 - South				Totals		Voltage	Totals		Voltage	Totals		Voltage
Area Covered						Current	Distance	Drop	Current	Distance	Drop	Current	Distance	Drop
Nominal System Voltage			20.4			2.071	530	**2.33**	2.071	530	**4.347**	2.071	530	**2.173**
Minimum Device Voltage			16			End of Line Voltage		**18.07**	End of Line Voltage		**16.05**	End of Line Voltage		**18.23**
Total Circuit Current		2.071		Wire	Ohm's		Percent Drop	11.42%		Percent Drop	21.31%		Percent Drop	10.65%
				Gauge	Per 1000	End of Line and Load Centering Methods use only the wire guage for the first device to source								
Distance from source to 1st device			20	12	1.98	Standard Wire Resistance in Ohms per 1000 feet.								
Wire Gauge for balance of circuit				12	1.98			18=7.77	16=4.89	14=3.07	12=1.98	10=1.24		
Enter current in amps.		Distance					18-14 Awg = Solid Conductors			12-10 Awg = Stranded Conductors				
.150 = 150 ma		from		Voltage		Notes:								
Device	Device	previous	At	Drop from	Percent	Wire resistance is doubled in the calculations for two wires (Positive and Negative)								
Number	Current	device	Device	source	Drop	The voltage calculated to the last device in any method must not be lower then								
Device 1	0.068	20	20.24	0.164	0.80%	the manufactures listed minimum operating voltage (IE: rated operating voltage 20-32 VDC).								
Device 2	0.068	30	20.00	0.402	1.97%									
Device 3	0.068	20	19.84	0.555	2.72%	Device Manufacturer		GE Security			Device Manufacturer		GE Security	
Device 4	0.068	30	19.62	0.777	3.81%				Current					Current
Device 5	0.161	20	19.48	0.920	4.51%	Horn Strobes		24v	@Rated		Strobe Only			@Rated
Device 6	0.161	30	19.29	1.114	5.46%	Model #		Candela	Voltage		Model #		Candela	Voltage
Device 7	0.094	30	19.11	1.290	6.32%	G1-HVDM	High dB	15	0.081					
Device 8	0.094	10	19.06	1.344	6.59%	G1-HVDM	High dB	30	0.094					
Device 9	0.094	30	18.90	1.497	7.34%	G1-HVDM	High dB	75	0.161					
Device 10	0.094	30	18.76	1.639	8.04%	G1-HVDM	High dB	110	0.203					
Device 11	0.094	20	18.67	1.727	8.46%	G1-HVDM	Low dB	15	0.068					
Device 12	0.161	30	18.55	1.846	9.05%	G1-HVDM	Low dB	30	0.088					
Device 13	0.094	30	18.45	1.947	9.54%	G1-HVDM	Low dB	75	0.156					
Device 14	0.094	30	18.36	2.036	9.98%	G1-HVDM	Low dB	110	0.197					
Device 15	0.094	30	18.29	2.114	10.36%									
Device 16	0.094	30	18.22	2.181	10.69%									
Device 17	0.094	30	18.16	2.237	10.97%									
Device 18	0.094	30	18.12	2.282	11.19%									
Device 19	0.094	30	18.08	2.315	11.35%									
Device 20	0.188	20	18.07	2.330	11.42%									
Totals	2.071	530	End of Line Voltage		**18.07**									

APPENDIX M
FIRE SAFETY MANAGEMENT PLAN

FIRE SAFETY MANAGEMENT PLAN

FOR

Taylor Place
120 E. Taylor Street
PHOENIX, AZ

Prepared by:

Christopher Thomas
Cal Poly - San Luis Obispo
FPE 551

November 12, 2015

City of Phoenix
Log Number LPRN XXXXX

STATEMENT OF DISCLAIMER

This plan is a result of a class assignment; it has been graded and accepted as fulfillment of the course requirements and not intended as a comprehensive document. Acceptance of this plan in fulfillment of the course requirements does not imply technical accuracy or reliability. Any use of information is done at the risk of the user.

These risks may include, but may not be limited to, catastrophic failure of the device or infringement of patent or copyright laws. California Polytechnic State University at San Luis Obispo and its staff cannot be held liable for any use or misuse of the plan.

This document was developed as a graduate project for the FPE 596 *Culminating Experience in Fire Protection Engineering*. It is not intended to be used for any other purpose.

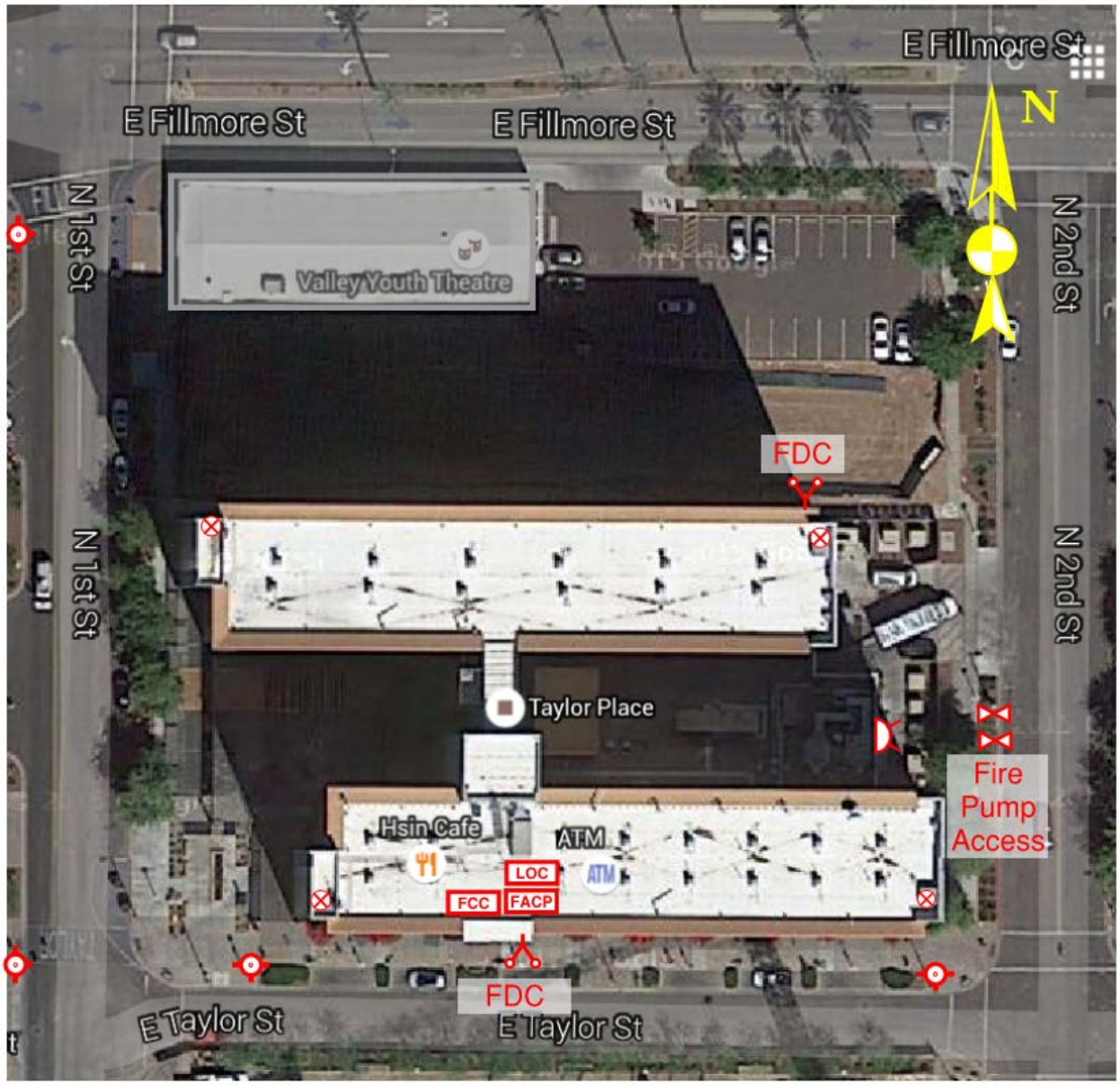
BUILDING AND SITE INFORMATION

The facility is a thirteen story dormitory consisting of Tower 1 (north) and Tower 2 (south) connected towers for Arizona State University. The building is fully sprinkled with a 24 hour security guard and resident assistant on staff. The building does not generate, or store hazardous waste or hazardous chemicals. The building is primarily a residential occupancy on the all floors. The ground floor will contain a large assembly area, a café, administrative offices, and four resident assistance (RA) suites. The south side of the Tower 2 at ground level consists of a coffee shop, and business or mercantile space that can be subdivided into 6 individual suites. Non-public areas on the ground floor include storage, offices, and access to the basement. The basement level of the dormitory contains five rooms with mechanical equipment including pumps, generators, boilers, and electrical equipment.

The second floor thru the thirteenth floor of Tower 1 and Tower 2 will consist of student dormitory rooms. Each floor will contain laundry facilities, elevator access, and a connecting open air bridge. A small common area in building 1 connects the 2nd and 3rd floors by a stairway which is not part of the egress path. This configuration continues for the 4th and 5th floors, 6th and 7th, etc…

The site is bounded by E. Fillmore Street, N. 2nd Street, E. Taylor Street, and N. 1st Street. The building will be 13 stories, approximately 246 feet high with 720 dorm rooms. There will be a service access on the east side of the building and an open plaza on the west side of the building.

Drawings have been included in the Exhibits to show a general layout of the facility. They show the plan views of the floor including egress and fire equipment.



Fire Department connections are located on the north and south side of the building with accessible Knox boxes. The fire department command center is located next to the security desk just inside the south entrance.

OBJECTIVES

Arizona State University and Taylor Place believe that ensuring the health and safety of residents, staff, visitors, service users and all relevant persons is essential to our success.

We are committed to:

- Preventing accidents and work related ill health.

- Compliance with statutory requirements as a minimum.
- Assessing and controlling the risks that arise from our work activities.
- Providing a safe and healthy working and learning environment.
- Ensuring safe working methods and providing safe working equipment.
- Providing effective information, instruction and training.
- Monitoring and reviewing our systems and prevention measures to ensure there effectiveness.
- Setting targets and objectives to develop a culture of continuous improvement.
- Ensuring adequate resources are made available for health and safety issues, so far as is reasonably practicable.

FIRE SAFETY MANAGEMENT TRAINING AND PLAN UPDATES

This plan will be reviewed on an annual basis or as changes dictate to ensure the residents and staff of Taylor Place are safe and the staff is prepared to respond to any emergencies that should develop. Training will be required annually for all staff and residents that are integral to the success of this plan and the safety of the residents.

EMERGENCY ORGANIZATION

If an emergency situation develops on the property, the discoverer should immediately call 911 and the Reception Desk.

After emergency services have been contacted, the Primary Emergency Coordinator is contacted first. If he is unavailable, the Alternates should be contacted in descending order as listed in Table.

The Primary Emergency Coordinator and alternates have the authority to commit the necessary resources to implement the contingency plan in the event of an emergency.

EMERGENCY COORDINATORS

Name / Address	**Responsibility**	**Approximate Travel Time (min)**	**Contact Information***
Property Manager	Primary Emergency Coordinator	30 min	Cell: Home:
Resident Assistant on Duty	Alternate No. 1	5 min	Cell: Home:
Security	Property Management Representative	5 min	Cell: Home:

Building Engineer	Property Management Representative Alternate	30 min	Cell: Home:

* Include Area Code

EMERGENCY ORGANIZATION MEMBERS

If an emergency situation develops at the facility, the Emergency Coordinator will notify the members of the Emergency Organization (EO) and First Responders, if necessary. The primary emergency coordinator and alternates have the authority to engage the EO and commit the necessary resources to implement contingency plan in the event of an emergency. The members of the EO and their responsibilities are listed below.

EMERGENCY ORGANIZATION RESPONSIBILITY

Responsibilities	Regular/Alternate	Day	Night
Spokesperson	Regular	Property Manager	Resident Asst.
	Alternate	Resident Asst.	Building Engineer
Sprinkler Valve Operator	Regular	Building Engineer	Security
	Alternate	Security	Building Engineer
Fire Pump Operator	Regular	Building Engineer	Security
	Alternate	Security	Building Engineer
Mechanic/Plumber	Regular	Building Engineer	Security
	Alternate	Security	Building Engineer
Electrician/HVAC	Regular	Building Engineer	Security
	Alternate	Security	Building Engineer

EMERGENCY TELEPHONE NUMBERS

These are emergency numbers to call in case of any Emergency.
In case of any emergency – call 911 first.

Contact	Phone Number
Management Office	602-555-1212

Security After Hours	602-555-1212
ASU - Operations	602-555-1212
Police Department	911
Fire Department	911

MEDICAL EMERGENCIES AND AREA HOSPITALS:

If you require medical attention:
Call 911. Be prepared to provide the address of the building (located on the cover). Inform officials of the lobby and suite locations.
Give them your name, the nature of the problem, the location of the person requiring medical attention, including the floor and suite number and direct them to enter at the Main Lobby.
Immediately after calling 911, call the Security Desk and/or Management Office, so building personnel can meet and direct emergency crews to your location.

Hospital	Address	Phone
Banner University Medical Center	1111 E McDowell Rd, Phoenix, AZ 85006	Information 602-839-2000
Directions: 1. Head west on Filmore toward 7th Street 2. Turn left on 7th Street 3. Turn right on McDowell Rd. 4. Turn right into the Hospital		Distance: 1.6 miles/6 min

EMERGENCY ACTION PLAN (EAP)

Please follow these procedures when responding to emergencies at Taylor Place.

Fire Reporting Procedure

If a resident or staff member discovers a fire or other emergency, he/she will immediately proceed to the nearest manual pulls station and pull the Fire Alarm box. Fire Alarm boxes are located near each exit.

If possible, the individual should contact building security to describe the nature and location of the fire. No attempt to fight the fire should be made except by trained personnel.

When the fire alarm sounds, all residents will immediately proceed to the nearest exit. Signs marked “EXIT” will lead residents to outer doors and stairwells. Elevators will be disabled from use and programmed to go to the first floor to aid firefighters or other emergency personnel.

If the alarm stops sounding, residents will still continue to complete their exit of the building.

The evacuation plan is to evacuate the fire floor, the floor above, and two floors below.

The Fire Department will sweep their area to ensure all occupants have exited each floor. The Emergency Coordinator will assign a staff member to complete a headcount and record names.

Property management residents and building security will follow their own checklists to ensure sprinkler valves, fire doors, and elevators are all operating and positioned in the manner consistent with an emergency evacuation.

All residents will proceed to the evacuation collection site, located on the far northwest corner of the property of Fillmore and 2nd Street. Once at the site, residents should meet with the staff member to make sure they have been checked off the headcount checklist.

If an associate knows they cannot physically use the stairs to evacuate the building, they should proceed to a pre-determined Refuge Area (also known as a Safe Haven). The fire crew will have a list of Save Haven residents in their area and will alert the appropriate emergency personnel to assist these individuals in their evacuation.

Only when the proper emergency officials or building security give the "all clear" is it safe to re-enter the building.

FIRE PREVENTION PLAN

FIRE HAZARDS

Flammable materials in the Taylor Place building are mainly limited to cleaning supplies located in the janitorial closets on the first floor, and a maintenance supplies in the basement.

Other fire hazards are limited to kitchen equipment and small electric hand tools located on the first floor.

Other fire hazards are located in the mercantile shops on the ground level, but these do not communicate to the building's interior.

Taylor Place is a no smoking facility. Smoking is not allowed on the property.

FIRE DEPARTMENT VISITS

Building management officials will work with City of Phoenix Fire Prevention to schedule regular meetings with the local fire department and emergency rescue personnel.

FIRE CREW

Action taken to control and extinguish incipient fires will vary according to the severity of the incident and its location. Small fires called incipient stage fires shall be extinguished immediately by the fire crew or the person discovering the fire (time is of the essence).

Fire Crews will respond to emergencies based on the decision of the Emergency Coordinators

IMPAIRMENT TO FIRE PROTECTION

Before Fire Protection control valves can be closed a Red Tag must be filled out and the property risk insurer notified.

SECURITY RESPONSE TO FIRES

When Security is notified of a fire, they will immediately call 911 and then the Emergency Coordinator.

If a smoke detector detects a fire, Security will call 911 and investigate the alarm to determine if there is an actual hazard.

EMERGENCY RESPONSE PROCEDURES

NOTIFICATION

When the EAP is implemented, the Emergency Coordinator will immediately notify necessary appropriate emergency response members.

The Fire and Police departments and will respond to an emergency and will take control of the scene when they arrive.

Residents will be immediately notified of an emergency situation requiring evacuation by activating the alarm system via one of the alarm pull stations located in the building or the Fire Alarm Control Panel.

The building is equipped with a mass notification system to communicate with residents in each selected zone.

In an event requiring residents to shelter in place, the mass notification system will be used to override the fire alarm to inform residents of what actions to take.

CONTROL PROCEDURES

Taylor Place Resident Assistants assist property managers and security to manage building operations over three 8-hour shifts. There is a designated Emergency Coordinator available each day. Security will be the designated coordinator after normal business hours and on holidays. The following is a discussion of specific control procedures for certain emergencies.

NATURAL DISASTERS

Natural disasters have the potential of injuring residents and/or damaging the environment through releases of hazardous materials. The most probable release scenarios would result from earthquakes, flood or roof failure.

SEVERE WEATHER ALERTS

Local weather service will issue advisories predicting areas of probable severe weather activity and the estimated duration of such activity.

If a Dust Storm Watch Is Issued - You will be notified via text with any instructions related to the watch.

If a Damaging Storm Occurs:
Move away from the exterior glass of the building to a central area near the corridor or elevator lobby. Stairwells are safe. DO NOT USE THE ELEVATORS.

As you move, try to close the doors of rooms, which have windows. Do not lock the doors.

DO NOT go to the first floor lobby or outside of the Building.

Keep your radio or television set tuned to a local station for information.

EARTHQUAKES

When an earthquake occurs, the ground will shake perceptibly for a relatively short time, perhaps only for a few seconds or for as much as a minute in a great earthquake,

Precautions to Take During the Earthquake:
Try to remain calm and to reassure others,
If you are indoors, move immediately to a safe place, Get under a desk, table, or work bench if possible, Stand in an interior doorway or in the corner of a room. Watch out for falling debris or tall furniture, Stay away from windows and heavy objects (such as refrigerators and machinery) that may topple or slide across the floor.
Do not dash for exits, since stairways may be broken and jammed with people.
Elevators may stop operating, Seek safety where you are at the time of the incident and then leave calmly if evacuation is necessary,

The electricity may go out, and elevator, fire, sprinkler, or burglar alarms may start ringing.
Expect to hear noise from breaking glass, cracks in walls and falling objects.
If you are outdoors, move to an open area, away from buildings and power lines.
Don't be surprised if you feel more than one shock After the first motion is felt, there may be a temporary decrease in motion followed by another shock (This phenomenon is merely the arrival of a different seismic wave from the same earthquake), Also, aftershocks may occur - these are separate quakes which follow the main shock
Aftershocks may occur several minutes, several hours, or even several days afterwards,
Sometimes aftershocks will cause damage or collapse of structures that were already weakened by the main earthquake,
Precautions to Take After the Earthquake:
When the shaking stops, there may be considerable damage and people may be injured. It is especially important that everyone should remain calm and begin the task of taking care of one another.
The first concern is for those who are hurt, and the next concern is to prevent fires.
After that, damage can be assessed and remedial measures begun.
Remain calm, and take time to assess your situation.
Help anyone who is hurt; administer emergency first aid when necessary. Cover injured persons with blankets to keep them warm. Seek medical help for those who need it.
Check for fires and fire hazards. Put out fires immediately if you can.
Check for damage to utilities and appliances. Shut off electricity if there is any chance of damage to wiring.
Shut off water valves if breakage has occurred. In due time, report utility damage to the utility companies and follow their instructions.
Do not light matches, or use any open flames, or turn on electrical switches or appliances, until you are certain there are no combustible fumes.
Do not touch power lines, electric wiring, or objects on contact with them.
Do not use the telephone except to call for help, or to report serious emergencies (medical, fire or criminal), or to perform some essential service.
Jammed telephone lines interfere with emergency services, and it is thoughtless to use the phone for personal reasons or to satisfy curiosity. (When the emergency is clearly over, contact relatives and friends so they will know you are safe and where you are).
Be certain that sewer lines are not broken before resuming regular use of toilets.
Clean up and warn others of any spilled material that are dangerous, such as chemicals, gasoline, etc.
Listen to the radio for information about the earthquake and disaster procedures.
Be prepared to experience aftershocks. They often do additional damage to buildings weakened by the main shock.
Use great caution when entering or moving about in a damaged building. Collapses can occur without much warning, and there may be dangers from electrical wiring, broken glass, etc.
There are no rules that can eliminate all earthquake danger. However, damage and injury can be greatly reduced by following the simple rules contained in these procedures.

UTILITY EMERGENCIES

GAS LEAKS

Gas leaks have the potential of causing an explosion that could injure residents and/or damage Taylor Place property through pressure impact or subsequent fire. To facilitate shutting off the main gas meter, permanently attach a properly sized wrench to the gas train to interrupt the gas flow. The following response shall be implemented where a gas leak is detected.
Call the gas company to report the leak. A representative from the gas company will come to the facility (usually within an hour).
Immediately, isolate the source of the leak (turn off the gas) if the source is known.
Remove any sources of ignition in the area (cut off power to any machines near the leak.)
Ventilate the plant/disperse the fumes.
Repair the leak (if possible, repair the leak internally.)
If the repair passes a pressure test performed by the gas company, the gas service can be reconnected.
If the gas company has to disconnect the gas, the gas service cannot be restored until an inspection has been performed.

If the fire department is called or responds to the leak, they have control over the plant/incident site. If an order is given to evacuate the building by the Emergency Coordinator, Gas Company, or the fire department, the entire building must be evacuated. No one will reenter the plant for any reason until the Emergency Coordinator in consultation with the fire department authorizes reentry.

POWER FAILURE

Taylor Place is designed to minimize the risk of a general power failure resulting from causes within the building. Typically, should a power failure occur, it will be due to a problem in the larger portion of the surrounding geographic area. All areas and public areas are equipped with emergency powered exit signs and emergency lights. These will remain lit in a general power failure.

If an electrical failure does occur, the following guidelines should be observed:
Contact the Reception Desk and/or Management Office
If you are instructed to evacuate, lock all areas.
Do not congregate in lobby areas or in the street.
If you are trapped in an elevator during a power failure, wait for assistance. Your elevator will cease operation, but WILL NOT FALL. Do not force open the doors or try to escape through the roof hatch. Ifthe power is restored while an escape is attempted, severe or fatal injuries could result. DO NOT PANIC. Once the emergency generator has started, the individual cars will start and return to the main lobby.
There is an emergency phone in all cars to assist you if you do become trapped. The phones dial directly to the elevator monitoring service.

The Management Room will attempt to advise you regarding the length and cause of the power failure as soon as possible.

PREVENTION OF RECURRENCE OR SPREAD OF FIRES

During an emergency, the emergency coordinator will take all reasonable measures necessary to ensure that fires do not occur, recur, or spread. These measures include collecting and containing released waste, removing or isolating containers, staging fresh extinguishing equipment, and proper use of fire control structures (e.g.: fire doors), systems, (e.g.: sprinkler systems), and equipment (e.g.: fire extinguishers. Stage fresh extinguishers and monitor the area from a safe location.

POST-EMERGENCY EQUIPMENT MAINTENANCE

Immediately after an emergency involving a large fire, explosion, or spill requiring the shutdown of equipment, the emergency coordinator will take inventory of all emergency equipment and materials. He will then have all emergency equipment and materials restored and replenished and ensure that all emergency equipment is clean and fit for its intended use before operations are resumed.

Emergency equipment and materials used to control small fires and spills that did not interrupt manufacturing operations, will be restored and replenished within one week after the emergency.

SALVAGE SQUAD AND SECURITY

After the emergency is under control, the Emergency Coordinator will determine when to it is safe to start salvage operations. The Emergency Coordinator will select the salvage squad to assist with recovery. The salvage squad will work to secure the facility against weather, sorting and saving salvageable stock, cleaning, ventilating smoky or humid areas and drying up standing water.

Salvage operations should start as soon as possible and focus on cleaning equipment with priority to major damage, safety systems, automatic fire sprinklers, vital equipment and processes, and valuable stock. It is important to begin contacting contractors as soon as possible to begin necessary repairs, rebuild, or replace emergency equipment. Use the FM Global Red Tag Kits if there is impairment to the building sprinkler system.

Be prepared to provide additional security and a fire watch for the building if required.

RESIDENT EVACUATION PROCEDURES

In order to ensure a clear, uninhibited entry for the Fire Department into the building and to the fire area, it is extremely important that all residents evacuate in the precise manner and to

the exact area designated by the Residents, Emergency Coordinator, or Fire Department. This should be at least 50 feet away from the building.
The following evacuation procedures should be observed:

- If possible, grab purses, wallets, valuables, etc. as soon as the order to evacuate is given. You will not be allowed back into the space until the Fire Department says it is safe to re-enter.
- Before opening any door to the corridor, check the door and doorknob for heat. If it is warm, stay in your roomand, if possible, find another exit to the corridor. DO NOT OPEN THE DOOR!
- If both your door and doorknob are cool, and you leave your office:
- Check for smoke in the corridor.
- When smoke is present, stay low by crawling since clear air is closest to the floor.
- Everyone should proceed quickly, but calmly to the nearest stairwell. DO NOT RUN! All the stairwells are constructed with a fire-resistant material to provide safe evacuation for building occupants and the building is fully sprinklered.

- DO NOT PANIC! Panic is the most harmful and most difficult element to control in an emergency. Avoiding panic is accomplished through the following steps:
- Knowledge of procedures which must be followed.
- Confidence in the responsible personnel's ability and guidance.
- Calmness and self-confidence of responsible personnel.
- DO NOT USE ELEVATORS! Elevators automatically return and remain at the lobby level where the doors will open during a building alarm and are not available for usage.
- Check stairwells for smoke.
- If the corridor and/or stairwells are smoke filled, RETURN TO YOUR ROOM.
- Once you are in the stairwell, should you encounter smoke on your descent, get out of the stairwell into any clear corridor and proceed to a different stairwell.
- If the corridor and/or stairwells are not smoke filled, proceed to the bottom floor, exit the building and meet at the location designated by the Department Safety Warden.
- Evacuate to areas discussed above to ensure you do not inhibit the firefighting activities.
- An Alternate Emergency Coordinator, Fire Department, or other responsible person(s) should be designated to walk the suite to assist employees and make sure everyone is aware of the evacuation order.
- The last person leaving any enclosed room or area should close the door, without locking it. This will help to confine any fire until the Fire Department arrives.
- Form a single-file line at the stairwell exit door and proceed calmly and carefully down the nearest stairwell to the first level, then outside to the area as designated above. No one should open any door without first checking to see if it is hot. If the door is hot, there may be a fire on the other side. Proceed to another floor.
- Keep conversation to a minimum. Stay in a single-file line on the right side of the stairwell.
- Once the evacuation has begun, no one should attempt to re-enter the evacuated area until it has been declared safe by the Fire Department.

- During evacuation, assist mobility-impaired persons to a room adjacent to the stairwell. One person should remain with the impaired person. Do not assist mobility-impaired individuals into the stairwell, as this will block the evacuation route. Fire Department personnel will meet them in this area and assist their evacuation to the designated rendezvous floor. The Emergency Coordinator should notify the Fire Department as to the location of mobility-impaired employees so that building personnel may pass this information to the Fire Department.
- If evacuation of an area is not possible because all escape routes are blocked by fire or thick smoke, the following procedures should be observed:
- Move as far away from the fire as possible. Close all doors behind you as you go. Every closed door between you and the fire provides a barrier against smoke.
- Stuff clothing or other material around cracks in the doors to prevent smoke-filled air from penetrating the area.
- Hang a cloth or other signal in the window to attract the attention of firemen. DO NOT BREAK THE GLASS! Under certain conditions, an open window may draw smoke into the area or hasten the flame's progress. I f the glass has been broken, there will be no way to stop the smoke from entering the room.

TERRORISM AND VILOENCE

Violent behavior is described as intentional actions taken by an individual that will endanger the health or safety of residents and staff or persons associated with the residents and staff.

The acts of violence can include but are not limited to:
Verbal abuse
Indirect threats
Direct threats
Nonverbal threats
Physical violence
Sabotage
Bomb threats

- Acts of Terrorism may be acts committed by persons not directly associated with Taylor Place, but their actions could cause injury, potential injury, or illness or otherwise jeopardize the safety of residents and staff or property.
- All acts outline in section will be thoroughly investigated and prompt appropriate action will be taken with any associate or individual determined to be in violation of this policy.
- The local police and fire department will be contacted when appropriate to deal with acts outlined above.
- In the event of a bomb threat or information on an act of terrorism is received, the person receiving the threat will immediately notify the Property Manager, and Building Security.

- Where applicable, all incidents that violate this policy will be reported to the appropriate local law enforcement agency.

MEDIA COMMUNICATION PROCEDURES

In order to endeavor promote a harassment free environment, Taylor Place does not allow media outlets onsite without prior notification. In the event that an emergency or incident occurs at the property and the media becomes notified or involved, we recommend that all inquiries from the media be answered with a "No comment" and directed to the Management Office.

EMERGENCY EQUIPMENT

A site plan is included in the exhibits showing the locations of all emergency equipment (i.e., fire control equipment, personnel protective equipment, first aid and medical supplies, decontamination equipment, and emergency communications and alarm systems). The list of the emergency equipment at Taylor Place and quantity of each item on-site is available at the security desk.

Fire control equipment includes hand-held fire extinguishers and wet pipe sprinkler systems. The sprinkler systems are activated automatically. Water supply to the sprinkler systems is provided by a fire pump with the capacity to deliver 500 gpm of water at 150 psi gage. The fire pump is located on the ground floor near the center of the building. It is accessed near the loading dock thru the double doors and the interior egress corridor.

Emergency communication equipment and alarm systems include: handheld radios, intercom telephones, a mass notification system, a beeper with voice transmission, and a fire alarm equipped with indicator lights for fire location warning bells, and manual pull stations activation boxes.

Emergency air is available in the stairwells for Fire and Rescue.

See evacuation plans for locations of emergency equipment on each floor.

BUILDING SECURITY

General Information Security plays an extremely important role in the overall smooth operation at The Taylor Place Building. Good security protects the property against carelessness, negligence, malicious mischief, vandalism, theft, safety hazards, sabotage and fire.

The security staff patrols the property on after-hours schedule (4:00pm to 8:00am). They are easily recognized as they are always dressed in uniform. Our security personnel act as a

deterrent to the would-be criminal as well as enforce building regulations, maintain order, and are on the alert for any unusual activities within the building.

Access to the buildings is available 24 hours a day, seven days a week through the Main Lobby.

There may be special instances when vendors or contractors need to perform work in your area during non-business hours. In such instances, please provide notification to the Management Office, which states the name(s) of the individual(s) and the company, and the approximate time and nature of the work to be performed. All vendors and/or contractors working in the building must sign-in and pick-up a temporary Contractor

RESIDENT SECURITY RESPONSIBILITIES

Remember that the best way to improve security for Taylor Place is to take an active role -just as you would in the neighborhood where you live.

Make sure all doors to your rooms are locked and secured. This is extremely important on the weekends.

Do not hesitate to report any suspicious or disorderly individuals to the Management Office. If necessary, our building personnel will escort them from the building.

Inform the Management Room of any building keys or badges which are lost. This includes keys to your room, and storeroom keys.

Keep building keys out of the hands of those who do not need them. Try to maintain up-to-date records of all your employees who have access. Inform the Management Room immediately when individuals have been removed from your employment for any reason.

THEFT

Should you suspect that your room has been broken into or if items are found missing, contact the Management Room and the Phoenix Police Department. In the meantime, try to avoid disturbing anything in areas that you feel might have been affected by an intruder.

LOST AND FOUND

Any individual finding lost item(s) should turn them in to Security located in the Main Lobby of the building.

ARRANGEMENT WITH LOCAL AUTHORITIES

Taylor Place has familiarized the City of Phoenix Fire and Police departments with the layout of the facility, properties of the hazardous waste handled and associated hazards, places where

facility personnel would normally be working, and possible evacuation routes. Taylor Place has had numerous fire inspections since 2007 when the facility was constructed; therefore, the Fire and Police department is intimately familiar with the site.

EVACUATION PLANS

Evacuation plans are posted throughout the facility so that exiting the building will be easy for personnel unfamiliar with the location.

The criteria for evacuation of the facility will be upon notification from the Emergency Coordinator.

An example diagram of the building showing all primary evacuation routes, exits, and rally points. If an alternate evacuation route is necessary, the employees will go directly to the closest unobstructed exit and assemble at the indicated rally points. There should be two evacuation routes for most locations in the plant that will lead employees through areas that are safe.

TRAINING

Initial and annual Training is required for all positions in the Fire Safety Management Plan. Training will be documented with date of training, content, and signatures of trainees on an acknowledgement form.

TRAINING MATERIALS

Training minimally consists of:

Emergency Coordinator (Person in Charge)

- Assesses the existing conditions and hazards present at your facility.
- Develops descriptions and instructions for emergency tasks and jobs.
- Assigns, trains, and motivates all EO personnel; maintains EO's staffing level and training.
- Familiar with the hazards of all operations throughout the facility.
- Qualified and familiar with the operations of fire protection equipment.
- Knows locations of control valves and fire pumps.
- Familiar with EO tasks and assignments.
- After an emergency, selects salvage squad when it is safe to return to the incident area.
- After the emergency, establishes salvage squad and maintenance priorities and plans.

Primary and Alternate Emergency Coordinators (Emergency Notifier)

- Contacts Public Fire Department, Police Department, and applicable state and federal agencies as appropriate to notify them of emergency.
- Contacts other EO members
- Alternate performs duties of Primary Emergency Coordinator in their absence.

The Sprinkler Valve Operator

- In an emergency, if the area where the valve is located is safe, the valve operator will manually “try” the valve to make sure it is open.
- Knows location of control valves and the area of the facility they control.
- Familiar with the operation of valves; knows how to check for “full open” position.
- Member of maintenance and inspection staff.
- Knows tools required for operation and has immediate access to keys, Bolt-cutter, and T-wrench.

The Fire Pump Operator

- Familiar with the fire pump. Checks the pump to make sure that it has started and, if not, starts it.
- If the area where the pump is located is safe, stands by the pump during operation in the event of problems.
- Makes sure suction and discharge valves are open.
- Are the tools and equipment necessary to operate and troubleshoot during an emergency immediately available to the operator?

The Mechanic

- Cuts off potential fuel supply to the fire (flammable liquids, and/or gases) and any systems that may interfere with fire fighting (steam, coolants).
- Monitors piping systems so they remain shut down and remain so until change is directed by fire Official.
- Works with Valve Operator to replace sprinkler heads after emergency to ensure continued fire protection.
- Knows the layout of distribution systems, and knows the location and operation of all primary and secondary shut-offs

The Electrician

- Cuts off power, which can contribute to an incident.
- Shuts down ventilation and HVAC system to cut off air to the fire, stop fire’s spread through ventilation ducts, and limit smoke damage.
- If there is a generator, checks to make sure that it has started and, if not, starts it.

- If the area where the generator is located is safe, stands by generator during operation in the event of problems.
- Checks operation of emergency lighting.
- Familiar with electrical, ventilation systems, and knowledge of shut-down (and start-up) procedures.

The Fire Crew

- Based on OSHA Standard 29 CFR Part 1910
- The Fire Crew is an organized group to attack incipient fire anywhere in the facility using extinguishers, or small hose lines, without the need for protective clothing or breathing apparatus
- Knows to report the fire first, then determine whether to fight it or not.
- Extinguishes fires while still in their incipient stage – that is, while still readily and safely controllable.
- Knows the location of fire extinguishers or how to locate them.
- Can determine if an extinguisher is the correct type to extinguish the fire.
- ABC Dry Powder extinguishers shall be used for flammable pool fires and warehouse fires.
- Carbon Dioxide (CO2) extinguishers shall be used first for fires on production equipment. ABC Dry Powder extinguishers can be used for fires on production equipment but should be a second choice.
- Personnel should work in the area to which they would be assigned.

The Salvage Squad

- After the emergency, the Emergency Coordinator selects salvage squad when it is safe to return to the incident area.
- After an emergency, the salvage squad will assist with recovery, securing facility against weather, sorting and saving salvageable stock, cleaning up; ventilating smoky or humid areas; drying up standing water.
- Works with Emergency Coordinator to establish salvage priorities and plans, including preparing emergency supplies and arranging for emergency services.
- Maintenance residents should be included in drying and oiling wet machinery, calling in outside contractors for repairs, special salvage operations, and starting processes back up

Emergency Coordinators

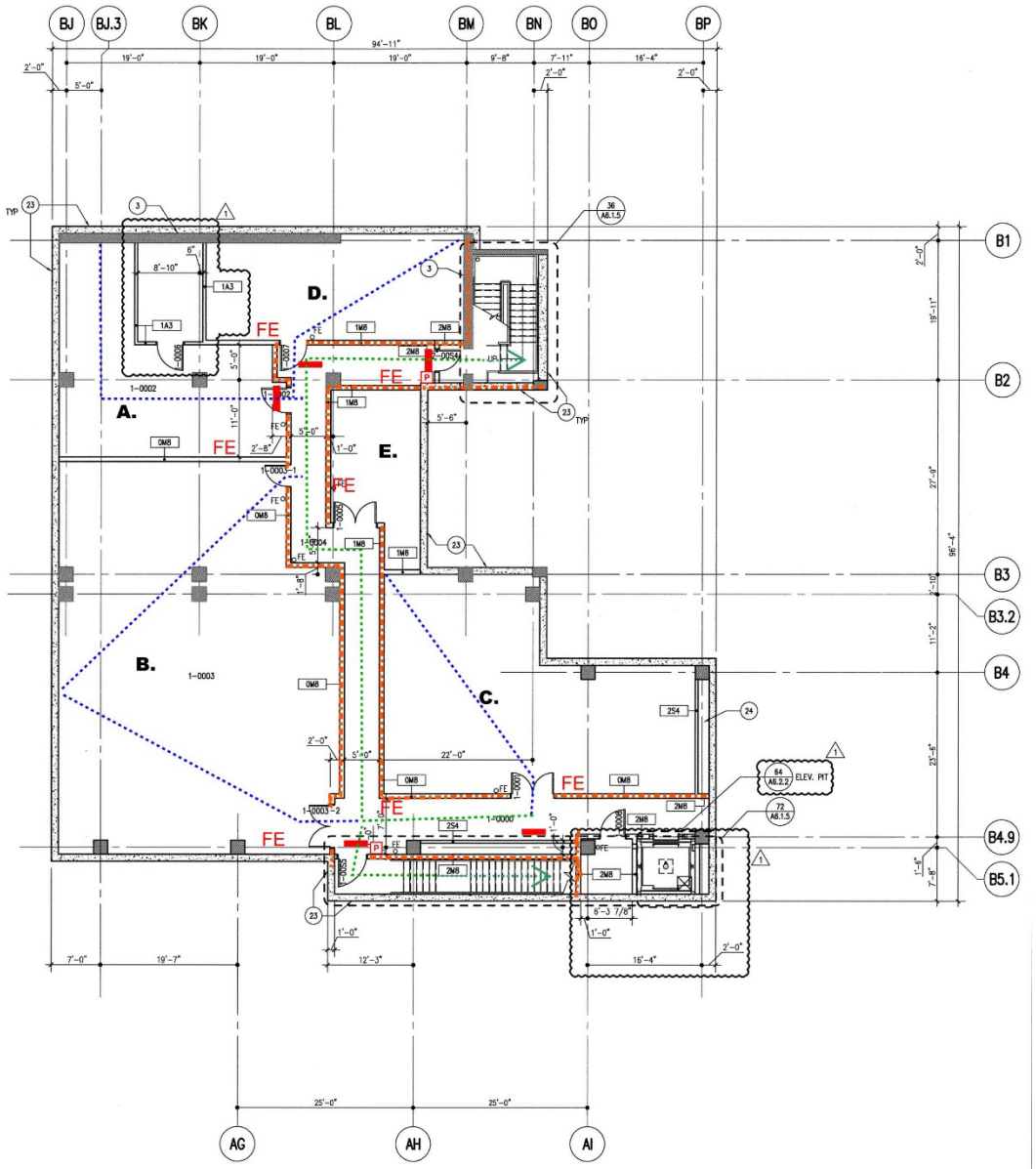
- Training coworkers in emergency procedures. This includes emergency evacuation, location of emergency exit routes and location of fire extinguishers.
- Providing a list of all mobility impaired coworkers to the Management Office.

- This list will be included in our firefighter's guide and will be available to the Fire Department in case of an emergency.
- Designating a coworker to assist any mobility impaired personnel with reaching emergency exits.
- Designating a meeting location for your suite in the parking deck at least 50 feet away from the building as a rally point in case of an evacuation.
- Ensuring your suite is completely evacuated before leaving. If individuals will not evacuate, please provide the number and location of these coworkers to the Emergency Coordinator upon your exiting the building.
- Updating the emergency contact list annually at a minimum with the Management Office. This list should include primary and secondary personnel with home phone numbers.
- These personnel will be contacted after hours if there is an emergency in your suite.
- Ensuring all personnel in your suite has access to the Bomb Threat/Nuisance Call Procedure Checklist.
- Surveying your suite in the event of a bomb threat to determine if there are any suspect devices in your suite. If one is found, leave it alone, evacuate your suite.

EXHIBITS

Legend

- Common Path
- Egress Path
- 1/2 hr. Fire Wall
- 1 hr. Fire Wall
- 2 hr. Fire Wall
- Exit Sign
- Deadend Corridor
- P — Manual Pull Station
- FE — Fisher Engineering
- Exit



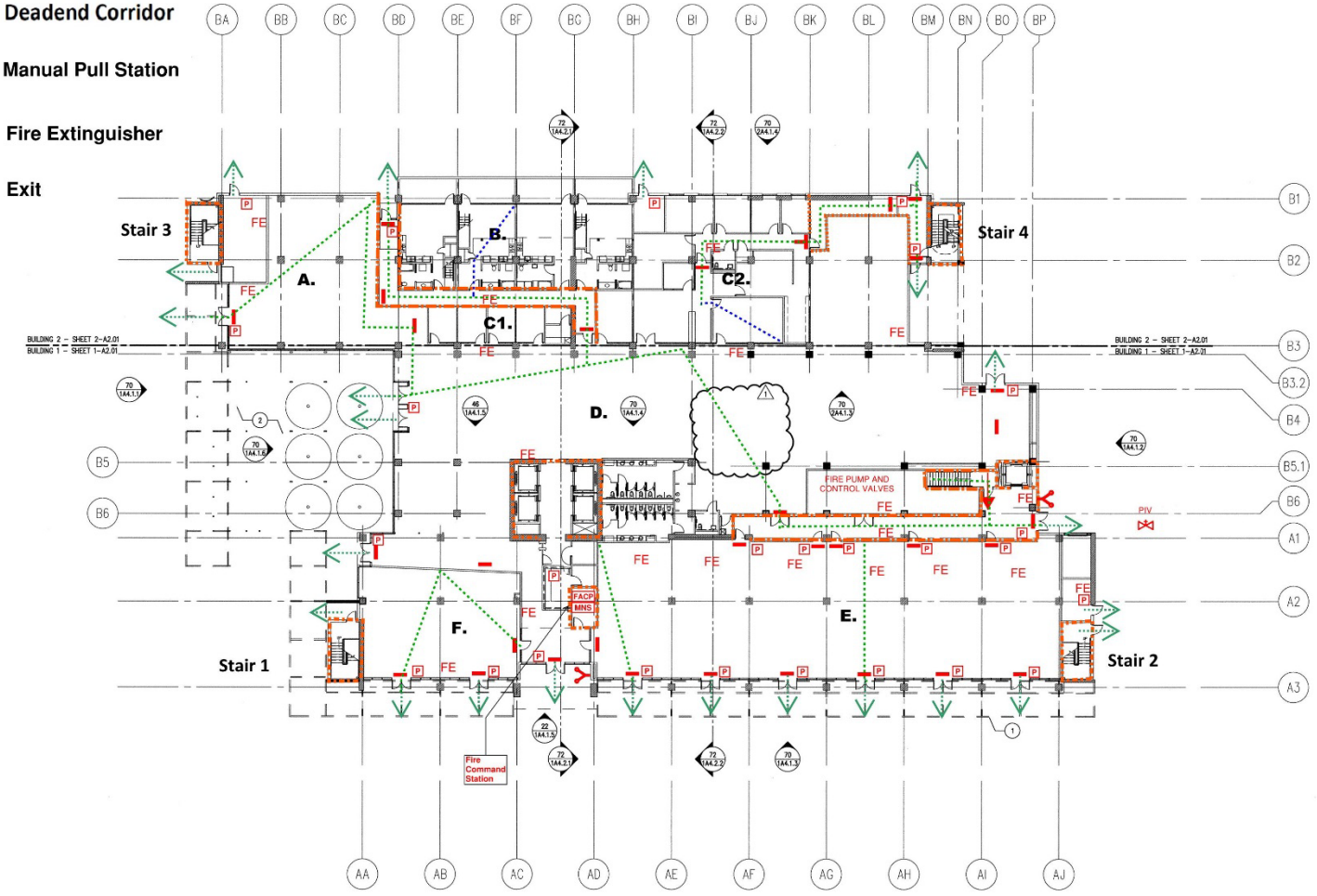
BASEMENT FLOOR FIRE PLAN

FIRST FLOOR FIRE PLAN

Legend

- Common Path
- Egress Path
- 1/2 hr. Fire Wall
- 1 hr. Fire Wall
- 2 hr. Fire Wall
- Exit Sign
- Deadend Corridor
- P — Manual Pull Station
- FE — Fire Extinguisher
- Exit

EVACUATION COLLECTION POINT



SECOND FLOOR THROUGH THIRTEENTH FLOOR FIRE PLAN